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SUMMARY REPORT
1953

RESEARCH ON OPERATIONAL
FEASIBILITY OF SCATTER
PROJECTILES

ER-365
REPORT NO.

8/26/54
DATE

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TABLE OF CONTENTS

	<u>Page No.</u>
I INTRODUCTION	1
II SINGLE PROJECTILE DEVELOPMENT	7
III 20 MM CLUSTER ROUNDS	17
IV SHOT GUN (12 GAGE)	26
V CONCLUSIONS	37
VI FUTURE PROGRAM	38
VII REFERENCES	39
VIII APPENDIX	40
1. Single Projectiles	41
2. 20 MM Rounds	49
3. 12 Gage Shot Gun	59
IX DISTRIBUTION LIST	76

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SUMMARY REPORT

1953

RESEARCH ON OPERATIONAL FEASIBILITY OF
SCATTER PROJECTILES

I INTRODUCTION

The objective of the work on contract Nonr-555(00) reported herein has been to continue research and studies concerning the operational feasibility of scatter projectiles. The research has been confined to scatter projectiles of a size which are suitable for ultimate use in a 20 MM round or a standard 12 gage shotgun.

During this research, the aim of the program was to establish the feasibility of 20 MM and 12 gage shotgun ammunition which would have a distribution of 80% of the projectiles in a six foot diameter at 100 yards range. In addition to distribution, consideration was given to other phases of the problem leading to a pre-prototype round, such as feasibility of manufacturing all of the ammunition components.

During the past year considerable progress has been made in manufacturing better projectiles at reduced cost. The techniques currently being used can readily be adopted for the manufacture of large production quantities of projectiles.

Projectiles are cold forged by use of a die set which is installed in a punch press and each complete cycle of the press produces a finished projectile. (See photographs on pages 3, 4 and 5). During the process of arriving at the final coining die material, die life ranged from 20 projectiles to hundreds.

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Finally two die materials were arrived at whose die life ranges into thousands of projectiles. These die materials are AIRDI No. 150 made by the Crucible Steel Company and Hampden Tool Steel made by the Carpenter Steel Company.

In addition to die material development, one of the greatest problems was to arrive at a suitable material for making the projectiles. The original projectiles were made of wire having a low carbon content and because of the setback loads on the projectiles encountered during firing it became necessary to harden them. With the material being used, it was only possible to case harden the projectiles and this resulted in poor uniformity since it was found that they ranged from soft to extremely brittle. The final material selected was supplied by the Bethlehem Steel Company of Baltimore, Md. and is of a type that may be heat treated. Use of this wire resulted in very uniform projectiles which, when fired, remained intact. The material is .088 diameter, 1060 steel wire which is spherodized, annealed, cleaned and bethalube coated to finish size. Formed projectiles are heat treated to an ultimate tensile strength of 190,000 psi.

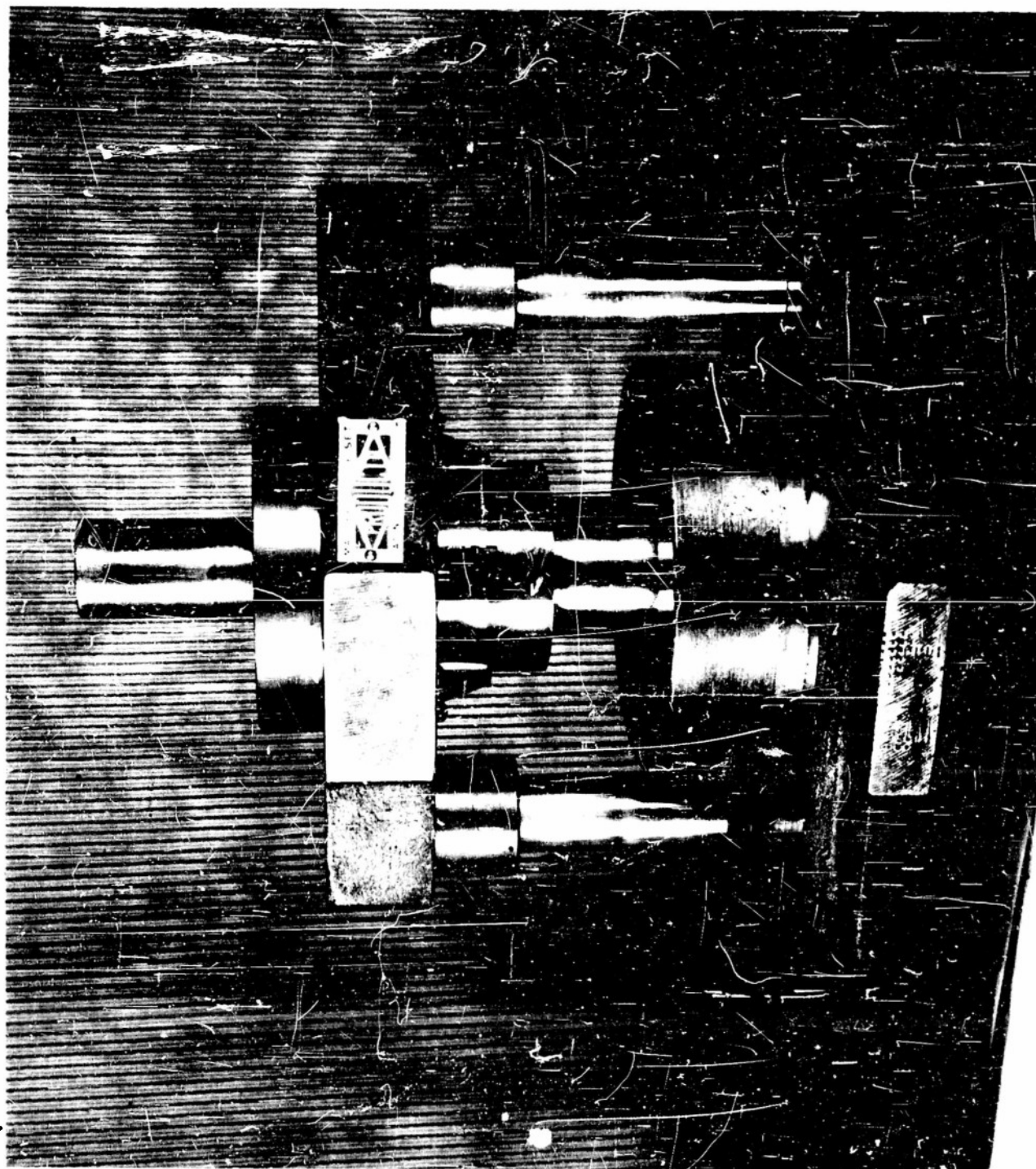
Progress is steadily being made regarding reduction of manufacturing costs of the sabots. However, until such time that the final sabot configurations may be set, it will not be possible to establish cost data.

As may be seen from the curve on page 6 of this report, accuracy of the heat treated projectiles was greatly improved over the low carbon steel case hardened type fired in the beginning of this program. The comparison is made only on projectiles having canted fins since they in turn were better than the projectiles not having canted fins. The improvement results from the greater uniformity and reduction of heat treating distortions.

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Photo No. 2092

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NOT YET ASSEMBLED

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PHOTO NO. 2591

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DIE SET SHUT

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Photo No. 2592

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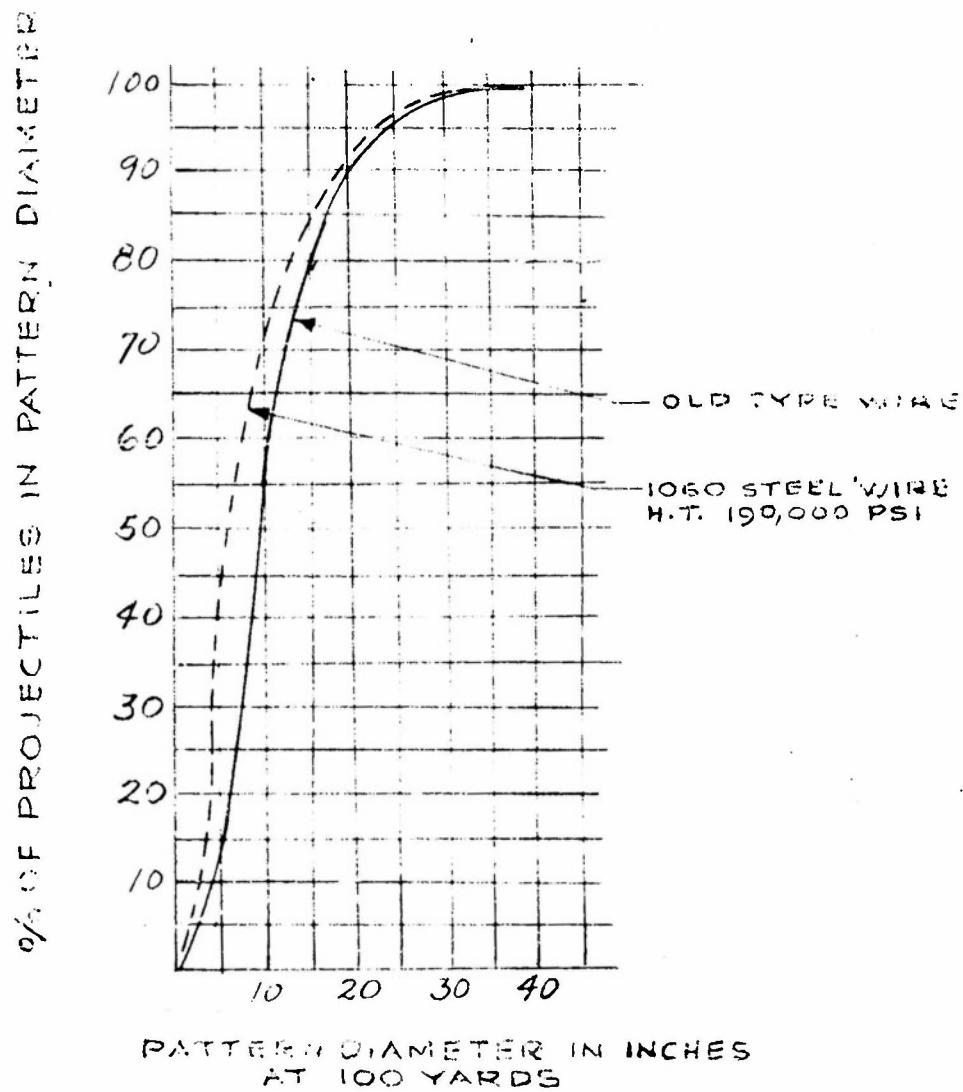


PIPE BOLT AND PROJECTILE

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20 MM PROJECTILES
SINGLE LAUNCHINGS
TWISTED OR CANTED FINS



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II. SINGLE PROJECTILE DEVELOPMENT

A. Purpose

To develop a projectile suitable for multiple firing with the following characteristics:

1. Capable of taking set-back force without deforming.
2. Stable under normal launching conditions.
3. Having accuracy suitable to fulfill characteristics discussed in the introduction.
4. Capable of being manufactured accurately in quantity.
5. Capable of being packaged as a round.

B. Studies

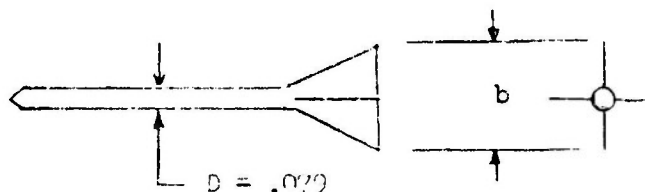
Ballistic and aerodynamic studies were made in the beginning of the program (Reference b¹) and additional studies were conducted as required during testing.

C. Tests

A test program was set up to establish the above characteristics and the projectiles were fired in the following manner:

1. Nos. 1 to 9 (Delta Fins)

These projectiles were fired during 1952 to establish the minimum span required to give a stability sufficient to continue further tests. The spans varied from .108 in. to .150 in.



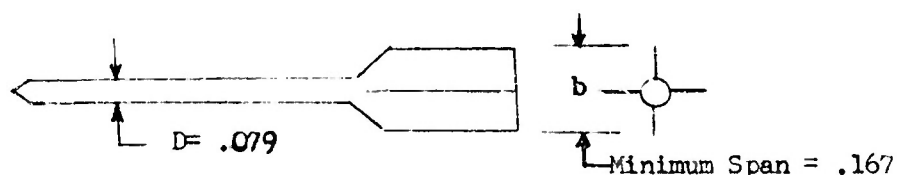
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These projectiles were made up by slotting the base and silver soldering fin inserts in place. The minimum span found to give any stability was .144 inches or b/D ratio of 1.82 for this configuration.

2. Nos. 10 to 23 (omitting Nos. 14 and 15 which were different types)

These projectiles had rectangular fins and their spans varied from .113 in. to .200 in. They were fired to establish minimum span.

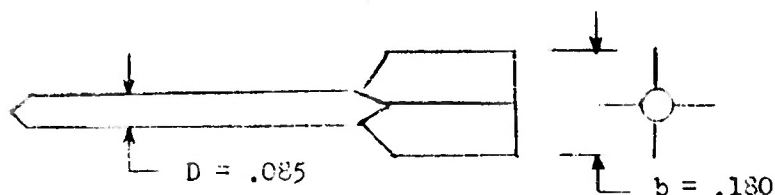


A minimum span or b/D ratio of 2.11 was found to be stable. The number of tests were limited due to the fact that the projectiles were handmade. Work then continued to establish a method of forming projectiles in quantities so that statistical results could be obtained. They were made on the forging machine described on page 1 of this report.

3. Rounds 24 through 30

The b/D ratio established previously was used in these tests:

$$b/D = 2.12$$



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The change in diameter was made in order to use wire available for machine forming. These projectiles were stable as measured by accuracy and no attempt was made to improve that accuracy. Most of the erratic results in accuracy were traced to the method of manufacture and heat treatment of the projectiles.

4. Straight Fin Projectiles Vs Spinning Projectiles

It may be seen from the plot of the 20 MM single launchings (page 12) that the percentage of projectiles hitting in a given diameter is much higher for the spinning type than for the straight fin projectile. This is due to the fact that manufacturing defects have less effect on a spinning projectile. Typical flight paths of the two types of projectiles is shown below in the non-dimensional graph.



The straight fin projectile tends to follow a curved path while the spinning projectile tends to follow a basically straight path.

5. Determination of Preferred Single Projectile

Approximately nine different types of projectiles were fired of both the 20 MM and the shotgun type to determine the best one to be used for future testing. Quantities of the different types fired ranged from 8 of one type to 98 of another. It may be noted from the charts on pages 13 and 14

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that the 2° machine formed 20 MM projectile was the best from an accuracy standpoint and that the 1° machine formed projectile was the most accurate in the shot gun type.

It was concluded after this testing that these projectiles were suitable for future multiple rounds. In order to reduce costs of manufacturing, the 2° machine formed projectile for both 20 MM and shotgun multiple firings was selected for future tests.

The photographs on pages 15 and 16 show a typical 20 MM and shotgun single projectile and sabot.

6. Stability Tests

Several of the different types of 20 MM and shotgun projectiles were fired at the Naval Ordnance Laboratory who jointly with AIRCRAFT ARMAMENTS, INC. conducted various tests and determined the stability characteristics of the different projectiles. It was noted during this testing that there was little difference between the 1°, 2° and 3° shotgun type projectiles whereas the 2° 20 MM projectile proved best. More detail information on these tests may be obtained by referring to NAVORD Report No. 2778 (Reference 'a').

It is to be noted that improvement can be made in the stability characteristics of both the 20 MM and shotgun type projectiles and AIRCRAFT ARMAMENTS, INC. is currently making plans to manufacture and test with the Naval Ordnance Laboratory additional new type single projectiles. One of the changes recommended by the Naval Ordnance Laboratory is to increase the fin chord length.

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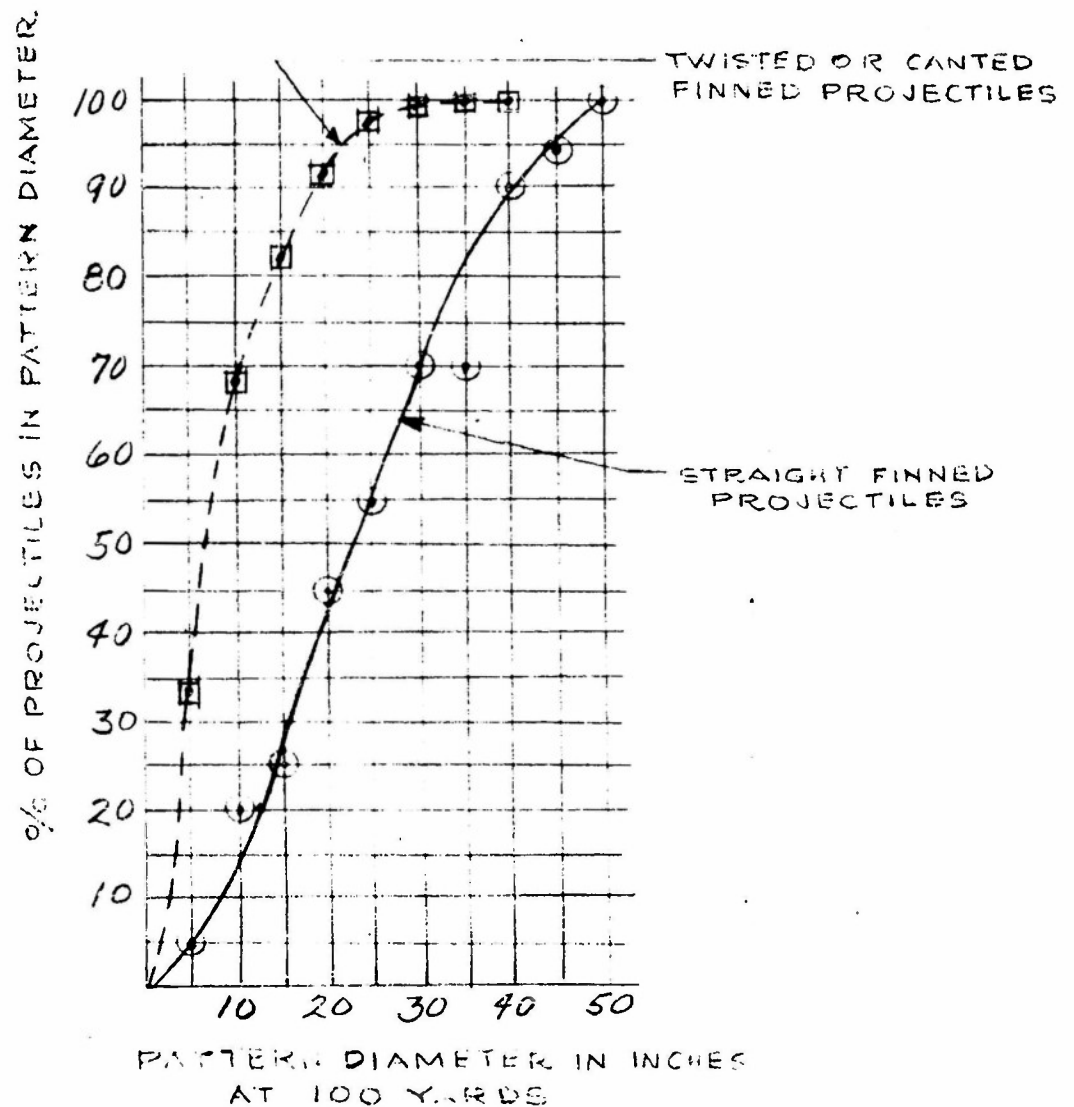
7. Lethality Tests

After preliminary studies were made lethality tests were conducted at Edgewood Arsenal for both the 20 MM (21 grains) and shotgun (17 grains) single projectiles. A report of the findings is currently being prepared and should become available by April 1954. Preliminary indications are that these projectiles are lethal and have satisfactory penetrating power.

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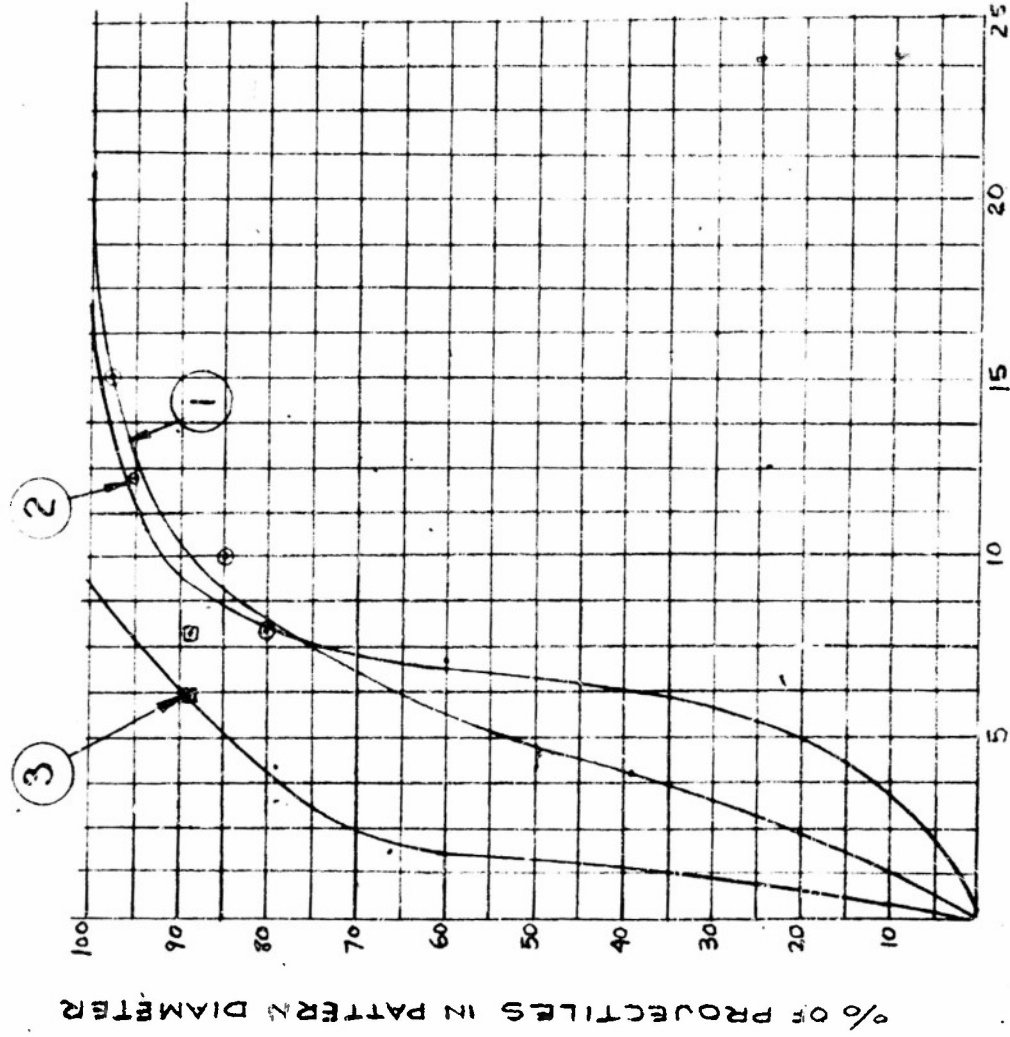
**20 MM PROJECTILES
SINGLE LAUNCHING**



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SHOTGUN PROJECTILES SINGLE LAUNCHINGS



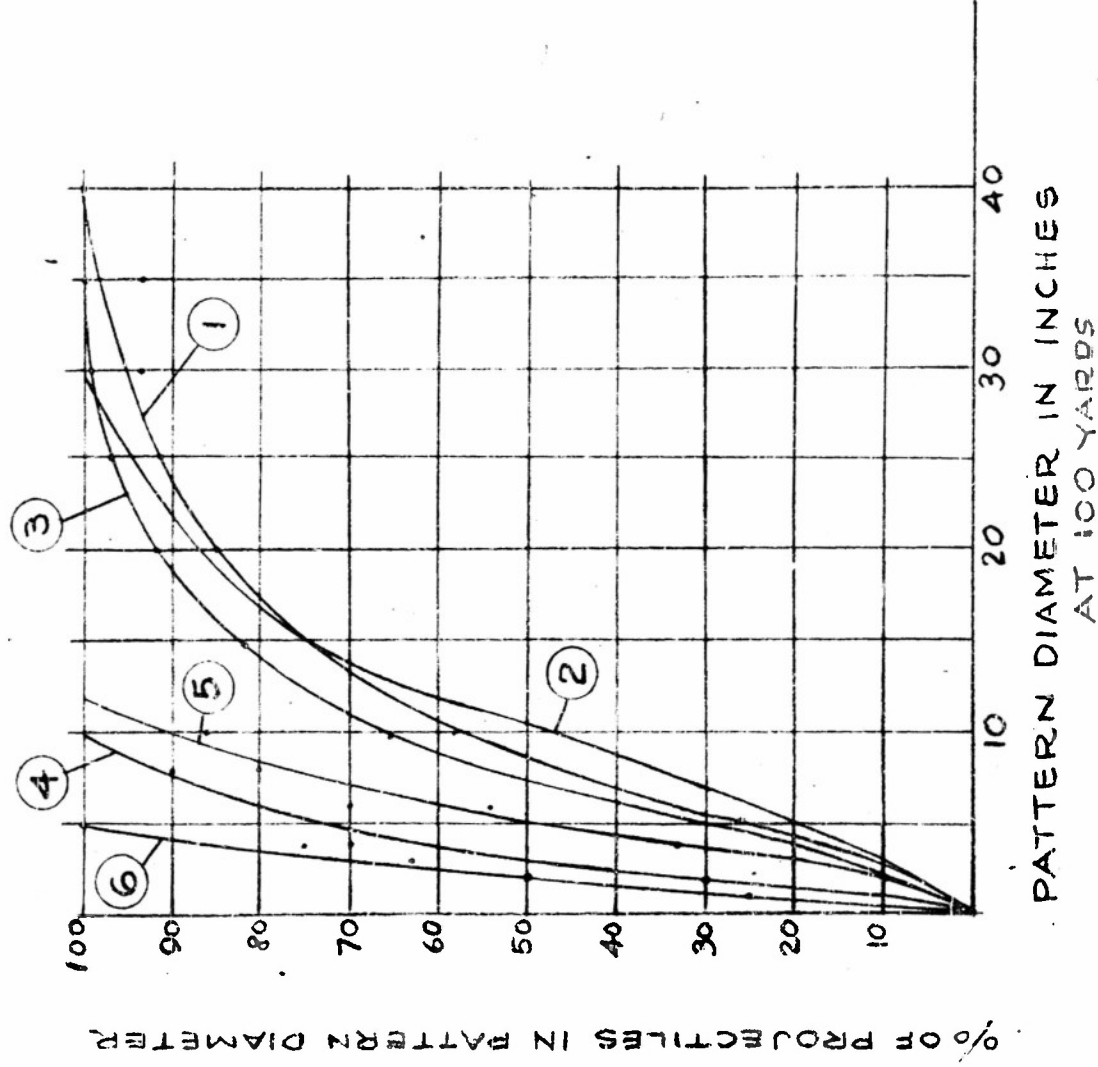
PATTERN DIAMETER IN INCHES @ 100 YDS.

CURVE NO.	DIAMETER OF CIRCLE ENCLOSING 80% OF PROJ. FIRED	PROJECTILE	FIN CANT	NUMBER ROUNDS FIRED
①	8.3"		3° MACHINE FORMED	10
②	8"		2° MACHINE FORMED	46
③	4"		1° MACHINE FORMED	9

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20 MM PROJECTILES
SINGLE LAUNCHINGS

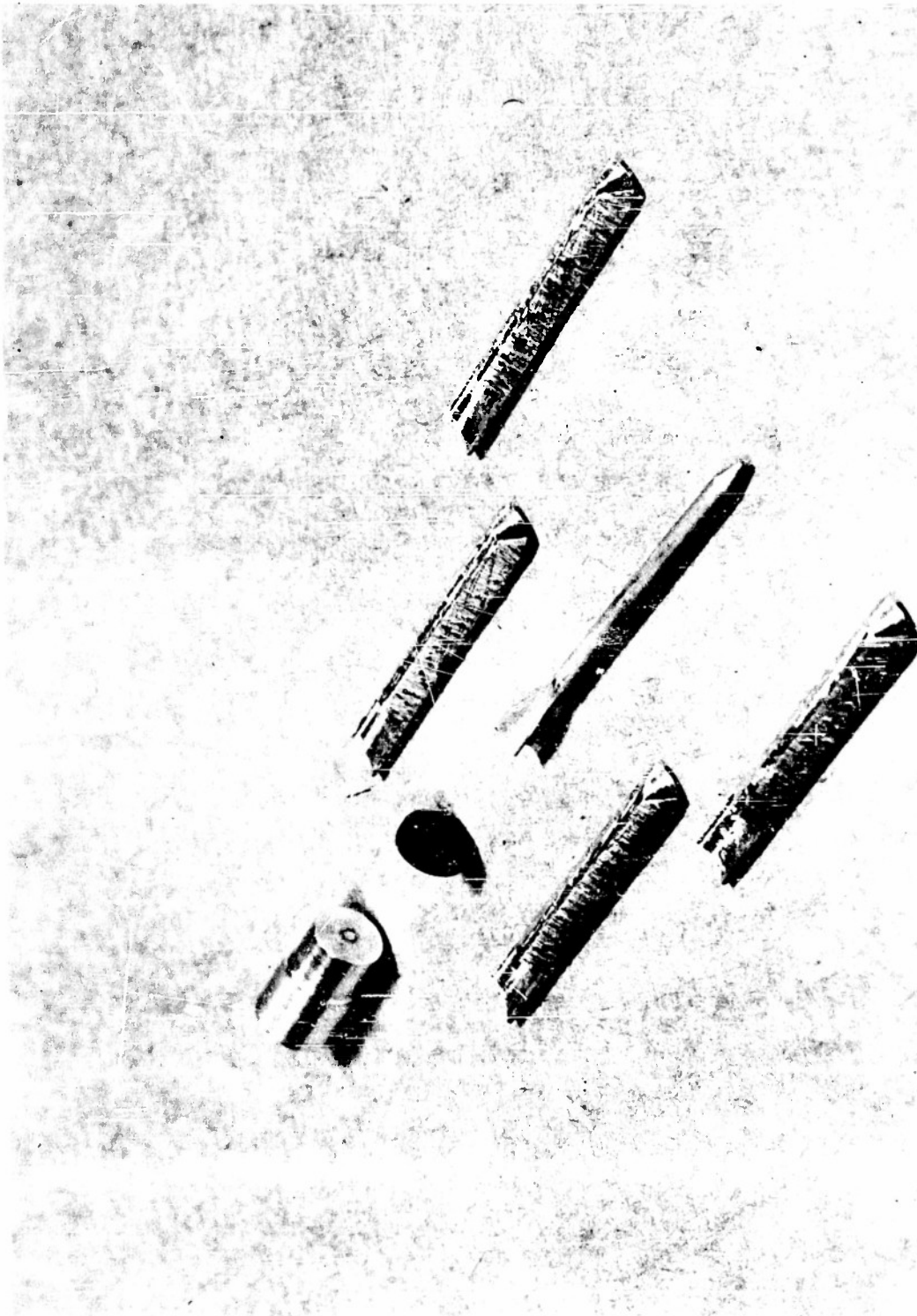


CURVE NUMBER	DIAM. OF CIRCLE ENCLOSING 80% OF PROJ. FIRED	PROJECTILE	FIN CANT	NO. ROUNDS FIRED
①	17.8"		7° HAND TWISTED	43
②	17"		7° MACHINE FORMED	15
③	14.5"		30° MACHINE FORMED	98
④	6.2"		20° MACHINE FORMED	10
⑤	8.5"		10° MACHINE FORMED	15
⑥	3.5"		20° MACHINE FORMED	8

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PHOTO NO. 2752

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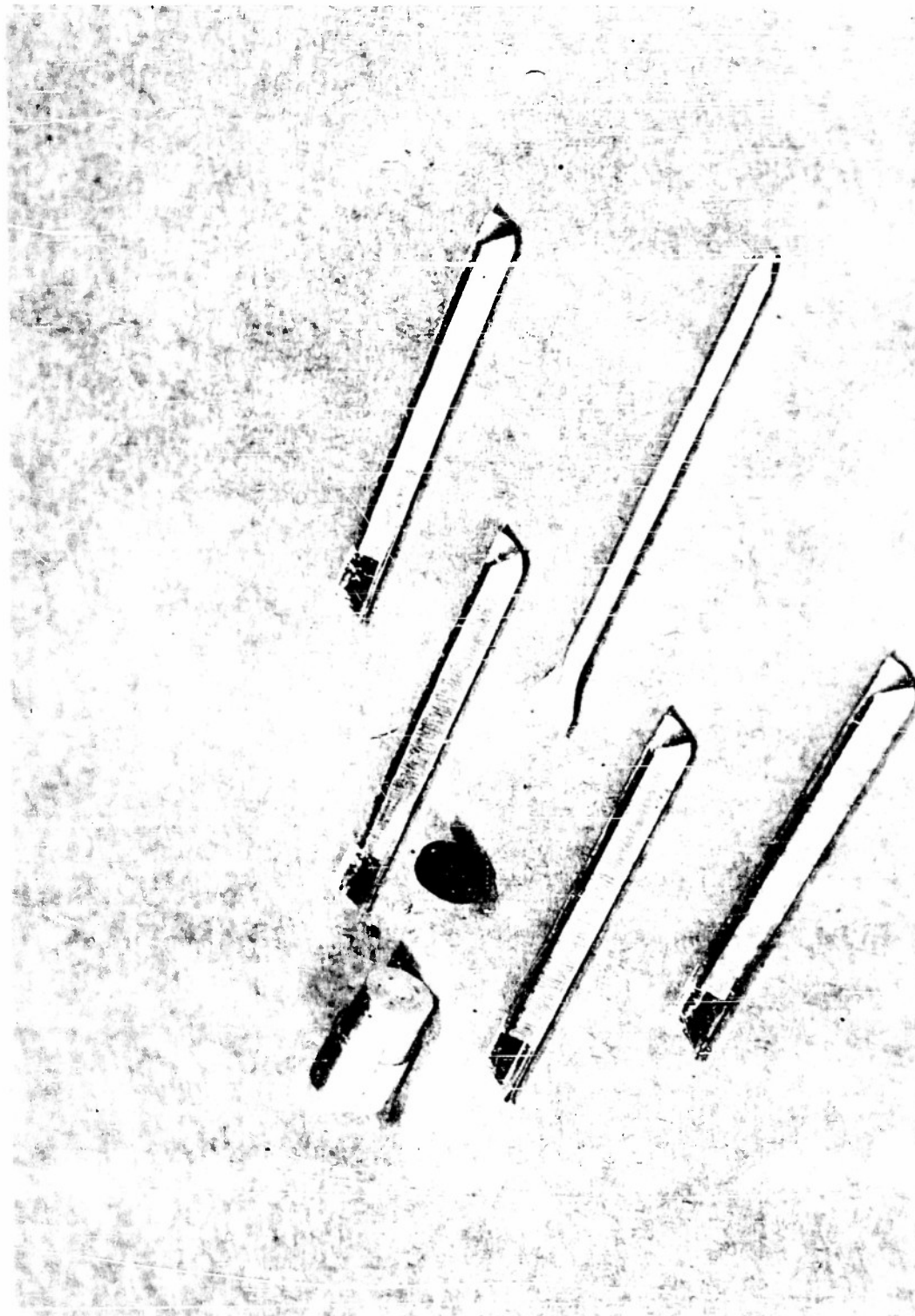


SHOTGUN - SINGLE

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Photo No. 2753

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20 MM - SINGLE

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III. 20 MM CLUSTER ROUNDS

A. Gun Tube Design

1. The initial concept of firing scatter projectiles from a 20 MM barrel envisioned use of a special low twist rifled tube in order to achieve required dispersion of projectiles. Combined with this low twist barrel was a stripper attachment to accomplish break-up of the plastic sabot housing a number of fin stabilized projectiles.

Results obtained on the first series of test firings numbers 1 - 11 (ER-137, page 31 -Reference 'b') indicated the following:

- a. The stripper action was successful in that the sabot was broken up.
- b. The yaw card traces indicated poor stability of projectiles and few hits were recorded.

2. A study of these results indicated the following factors may have affected dispersion and lack of stability:

- a. The projectile fins were damaged due to acceleration loads in the gun.
- b. The stripper action may have been detrimental to projectile stability. (This might be indicated at a later date after further studies are made.)
- c. The tube twist due to rifling created high angles of yaw.
- d. The slotted back plate into which the projectile fins were placed caused damage to the fins.

3. It was decided to accomplish future firings using a smooth bore tube of .675 inch diameter and to do as much test firing as possible with a 12 gage smooth cylinder bore shotgun so that cost of the rounds would be reduced.

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The decision to use a smooth bore tube appears to be correct as a large number of rounds have subsequently been fired in both a 12 gage shotgun and a smooth bore 20 MM gun tube with considerable improvement in dispersion characteristics. Results are plotted on page 22 and do confirm this observation.

B. Sabot Design

Considerable experimentation on sabot design and packing medium has been conducted. The original firing (rounds Nos. 1 - 11) incorporated a plastic sabot which was intended to break up due to stripper action at the muzzle. The resulting dispersion was extremely high and consistent results could not be obtained. Upon review of the possible causes of this dispersion it was felt that the sabot break-up by stripper action may have disrupted the projectiles and that the heavy ballast plug pushing the sabot caused the projectiles to tumble.

For the 20 MM tests it was decided to use a standard 20 MM charge and projectile weight so as not to alter the internal ballistics of the gun. To obtain velocities of the order of 2800 feet/second it is necessary to have a total projectile weight of 2000 grains \pm 50 grains.

Total weight with a maximum number of projectiles packed in a sabot (from 16 - 32 projectiles) was approximately 790 grains. This requires that a sabot and ballast must weigh approximately 1200 grains.

In order to distribute the mass so as to have the larger portion forward of the base plug, steel was substituted for plastic as the sabot material. This, of course, eliminated the use of a stripper for sabot

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separation and a new method of splitting the sabot into 4 segments was introduced. See photo on page 21 for typical 20 MM round.

Rounds Nos. 24 - 53 incorporated a split steel sabot of approximately 2 inch length and a 500 grain base plug. The results improved greatly as to dispersion and reasonable repeatability.

During this period various packing mediums were investigated. Wood fillers between projectiles were tried first and results appeared to be good. However, the inherent high cost of such packing methods led to experimentation with a frangible plastic type material. In addition, some indications were present that the wood filler strips interfered with proper cluster separation.

A few rounds using commercial rosin were fired and it was found that the rounds packed with rosin gave approximately the same results as when packed with wooden fillers. However, it was noted that the rosin had a tendency to adhere to the projectiles probably causing instability in flight. This was practically eliminated by zinc plating the projectiles. Rounds fired with zinc plating appeared to improve dispersion to some extent.

A limited number of photographs were obtained at the Naval Ordnance Laboratory and, although no conclusions were apparent, it was decided to investigate a number of sabot designs and packing methods. After firing those different configurations a selection for confirmation firing would be accomplished. NAVORD Report No. 2893 (Reference 'c') shows a photographic study of sabot separation of scatter projectile clusters.

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C. Results

Rounds Nos. 54 - 92 were fired and observation of data sketches shown on pages 22 and 50 will show that Type XII and Type H show best dispersion characteristics. (Approximately 9 projectiles in 6 foot diameter at 100 yards or a projectile density of .3 projectiles/square feet in a 6 foot diameter). Observation of data sheets on pages 24 and 25 and curves plotted on pages 22 and 23 will show graphically the firing results of this phase of the program to date.

D. Remaining Design Problems on Sabot

Additional studies should be made in order to increase the payload vs. the total weight of the round. This may be accomplished by utilizing a different powder charge and/or increasing the velocity, but requires variations in the interior ballistics of the gun. These changes were not desired to be incorporated at this stage of the investigation.

E. Lethality Studies

It is currently planned to conduct lethality tests at Edgewood Arsenal similar to those conducted on the single projectiles.

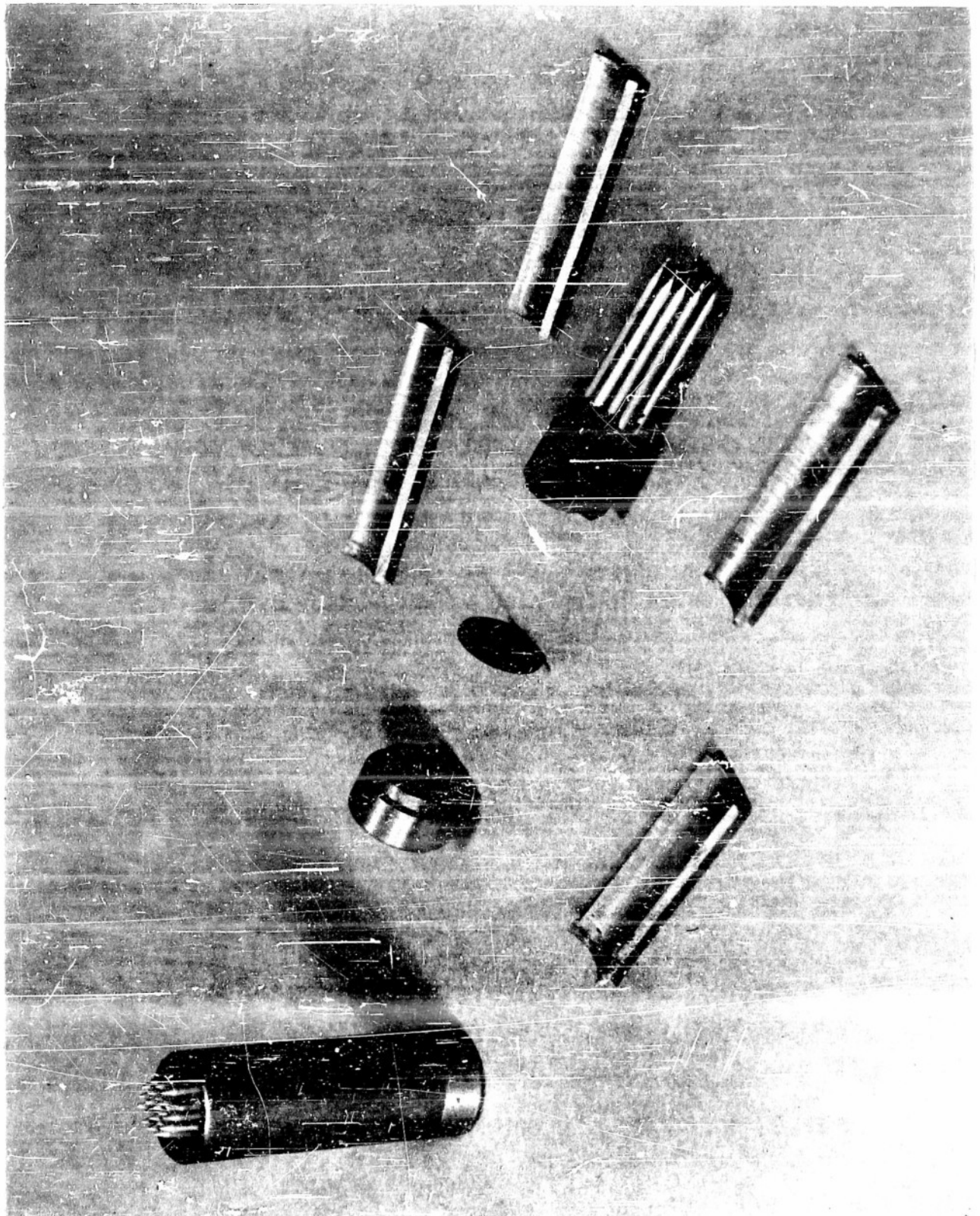
F. Wind Tunnel and Photographic Data

Studies and wind tunnel tests will be made at the Naval Ordnance Laboratory to determine the aerodynamic effects on the projectiles during cluster separation. In addition continued photographic studies will be made in order to establish possible sabot redesign so that better cluster separation may be obtained.

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PHOTO NO. 2750

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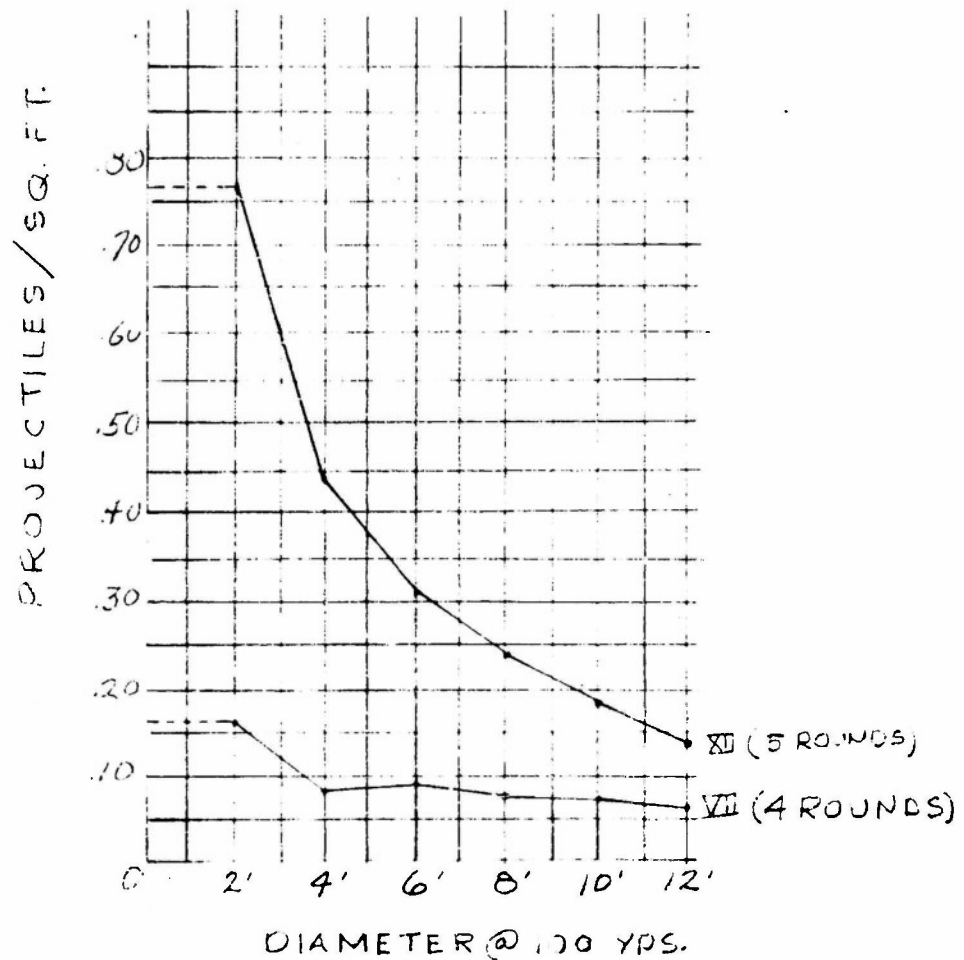


20 MM ROUND

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20 MM
BEST & WORST OF ALL TYPES
(BASED ON LARGER NUMBER OF
ROUNDS FIRED)



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20M Multiple Launch

Round Type	Number Rounds Fired	Number Projectiles/Proto- Round type	Fin Span Cant	Number of Projectiles in Diameter				Total Remarks
				2 ft.	4 ft.	6 ft.	8 ft. 10 ft. 12 ft.	
A	6	21	No	.180	30	3	7 10 15 17 19	20 Best 16 Average
						1.33	3.33 5.83 8.83 10.83 13	
B	3	21	"	.197	30	1	3 8 15 17 17	17 Best 16 Average
						1	2.66 6.3 11.6 14.6 15.3	
C	4	21	"	.197	30	3	5 11 14 18 18	21 Best 17 Average
						1	3.75 7.2 9.75 13.2 14.5	
D	1	21	"	.197	30	3	6 11 13 16 18	19 Best Average
E	3	21	"	.197	30	1	4 9 11 15 17	17 Best 15.3 Average
						.33	2 5 7.66 11.66 13	
F	4	21	"	.197	30	4	5 7 12 17 18	18 Best 15 Average
						1.5	3.75 6.25 10.25 13 13.75	
G	3	21	"	.197	30	1	6 10 12 15 18	19 Best 15.66 Average
						.33	3.66 7.66 9.66 13.3 14.66	
H	4	21	"	.197	30	3	10 13 16 18 19	19 Best 18 Average
						1.75	5.5 9 12.2 15.2 16.5	
I	5	42	"	.175	20	2	6 10 11 14 18	27 Best 24.8 Average
						.8	2.8 5. 8.6 12.6 17.4	
XI	5	21	"	.200	20	2	7 9 14 18 20	21 Best 15.8 Average
						1.2	4.4 7.2 9.2 12.4 14.2	
XII	5	21	"	.200	20	5	8 11 14 15 17	18 Best 18.2 Average
						2.4	5.6 8.6 12.2 14.2 16.2	
IV	5	21	"	.200	20	3	8 13 17 18 18	18 Best 13.8 Average
						1	2.8 4.8 7 8.8 12.4	
X	5	21	"	.200	20	2	5 9 12 15 16	20 Best 19.4 Average
						1	4.4 6.6 9 12 14.8	

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20MM Multiple Launch

Round Type	Number Rounds Fired	Number Projectiles/ Round	Proto- type	Fin Span	Fin Cant	Number of Projectiles in Diameter						Total Remarks
						2 ft.	4 ft.	6 ft.	8 ft.	10 ft.	12 ft.	
III	5	21	No	.200	2°	3 1.8	7 4	11 6	12 7	13 9.2	16 11.6	21 Best 20 Average
VII	4	21	"	.200	2°	0 .5	0 1	4 2.5	7 3.5	9 5.5	11 7	14 Best 11.75 Average
XVIII	5	21	"	.200	2°	1 1	4 2.8	9 5.1	13 7.8	17 9.8	13 12.2	21 Best 18.8 Average
XV	5	32	"	.200	2° 1°	2 1.6	8 3.6	12 8	16 12	19 15.6	21 17.6	28 Best 26.4 Average
XVII	4	21	"	.200	2°	2 1	4 2	10 5	15 8.5	17 9.8	18 14	20 Best 18.7 Average

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IV. SHOTGUN (12 GAGE)

A. Purpose

During the course of 20 MM work it was found practical to utilize a 12 gage shotgun for preliminary evaluation of the type rounds to be used in 20 MM work. This decision was arrived at since it appeared that the costs of the total round would be cheaper and the use of a 12 gage shotgun would be less cumbersome than the 20 MM cannon.

While this was the prime reason for use of this caliber gun, it was later found during the course of the program that a weapon of this type would be an asset to the military and a joint program was conducted of both the 20 MM and shotgun type round; for that reason, more emphasis was placed on the 12 gage shotgun work than had originally been planned.

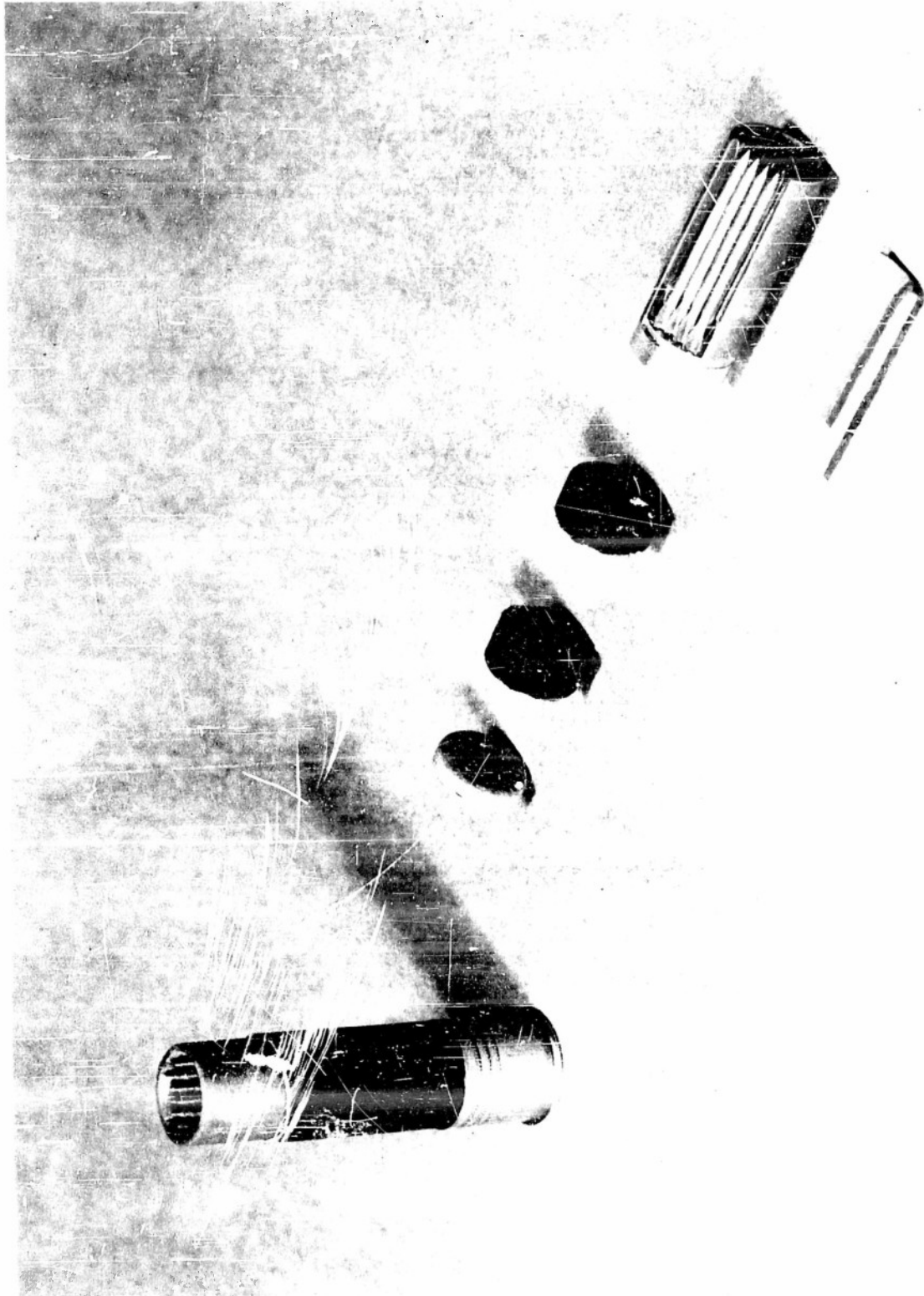
B. Sabot Design

The problems of the sabot design in the 12 gage shotgun were unlike those of the 20 MM cannon since, in order to utilize a standard charge, the total round weight could not exceed 600 grains and still maintain approximately 1450 ft/sec. It was found that the larger portion of the weight (approximately 480 grains) would be made up of projectiles (32 per round) and it became necessary to arrive at a sabot which would not exceed the remaining 120 grains. For this reason, plastic sabots were selected and in general the total round weight does not exceed 600 grains. These plastic type sabots appear to be inexpensive from the manufacturing standpoint since they lend themselves to molding practices and in addition their lightness should result in less disturbance to the final dispersion of the projectiles. Photographs of a launcher and a typical shotgun round are shown on pages 27 and 28.

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Photo No. 2751

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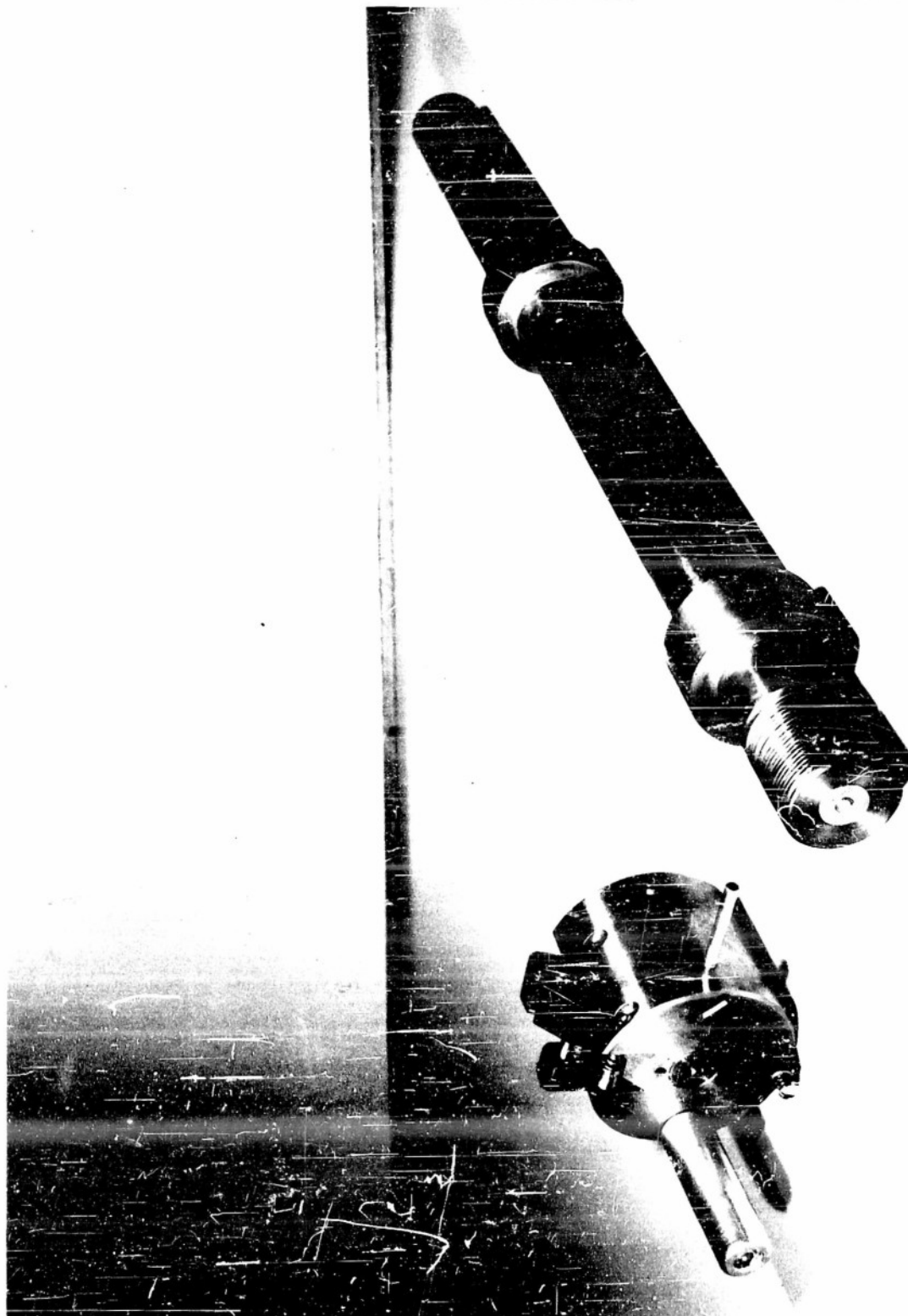


SNOUT 100-10000

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Photo No. 2593

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DRY FIRE TRAIN FRAME

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C. Results

Observation of data sheets shown on pages 30 to 32 and curves plotted on pages 33 to 36 will show graphically the firing results of the program to date. It is not possible at this time to determine what rounds appear to be best and it is planned that additional firing of the better rounds incorporating some changes will be fired in the future. It may be noted, however, that round "J" shown on page 33 is an indication of what may be obtained when repeatability is accomplished.

D. Design Problems

Although it appears that the shotgun round is closer to a pre-prototype round, it is believed that this is only true from the packaging standpoint. One of the problems still remaining is that of producing a denser pattern. A study will be made to establish the criteria for this type of round and upon completion of this study, attempts will be made to obtain the proper round.

E. Lethality and Wind Tunnel Data

Similar studies and tests to those conducted for 20 M4 rounds have been and will be conducted on the 12 gauge shotgun rounds.

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12 Gauge Shotgun

Round Type	Number Rounds Fired	Number Projectiles/Proto-type	Fin Span Cant	Number of Projectiles in Diameter				Total Remarks
				2 ft.	4 ft.	6 ft.	8 ft. 10 ft. 12 ft.	
ER228-I	9	21	No	1	3	6	8 9.5 11.5	13 Average 18 Best
	9	21	No	2	5	7	11 13 17	
ER228-II	49	21	No	1	4	7.5	10.4 12.7 13.2	14.8 Average 21 Best
	49	21	No	2	7	14	21 21 21	
ER228-III	7	21	No	.5	2	4.7	7 10 11.7	14.7 Average 19 Best
	7	21	No	1	5	10	13 16 18	
R	2	32	Yes	.5	3	5.5	6.5 12 13.5	14.5 Average 16 Best
	2	32	Yes	0	2	7	7 13 15	
S	1	32	Yes	1	4	4	7 8 9	10 Average 10 Best
	1	32	Yes	1	4	4	7 8 9	
Q1	2	21	Yes	.5	2.5	4.5	9.5 10.5 15	16.5 Average 19 Best
	2	21	Yes	1	3	5	10 12 18	
Q1	2	21	Yes	2	4.5	9.5	13.5 15.5 17.5	17.5 Average 19 Best
	2	21	Yes	4	4	10	14 17 19	
A	6	32	Yes	.7	2.7	6.7	10 14 17	19 Average 24 Best (Torn)
	6	32	Yes	0	4	8	14 17 22	
E	8	32	No	.4	1.6	3.1	5.9 7.5 9.5	17.2 Average 26 Best (Torn)
	8	32	No	0	2	6	9 10 13	
E	8	32	No	.8	3.1	6.5	10.1 12.4 14.4	20 Average 27 Best (Torn)
	8	32	No	0	6	11	18 21 23	
C	8	32	No	1.3	2.5	4.6	8 11 13	17.8 Average 26 Best (Torn)
	8	32	No	2	8	13	19 23 24	

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12 Gauge Shotgun

Round Type	Number Rounds Fired	Number Projectiles/Proto-type	Fin Span	Fin Cant	Number of Projectiles in Diameter					Total Remarks	
					2 ft.	4 ft.	6 ft.	8 ft.	10 ft. 12 ft.		
FII	2	28	.160	20	.5	2	6.5	9.5	13.5	17	23.5 Average
	2	28	.160	20	1	2	7	10	15	19	23 Best
ER228 - IV	3	21	.175	150	0	3	3	11	11	11	11 Average
	3	21	.175	150	-	-	-	17	17	17	17 Best
ER228 - V	1	21	.175	00	-	-	8	8	8	8	8 Average
	1	21	.175	00	-	-	8	8	8	8	8 Best
I	2	21	.175	00	0	2.5	5.5	5.5	5.5	5.5	5.5 Average
	2	21	.175	00	-	-	6	6	6	6	6 Best
II	2	21	.175	70	0	5.5	10.5	10.5	10.5	10.5	10.5 Average
	2	21	.175	70	-	11	11	11	11	11	11 Best
	4	21	.175	30	-	12.7	12.7	12.7	12.7	12.7	12.7 Average
	4	21	.175	30	-	17	17	17	17	17	17 Best
	3	21	.175	30	-	-	7	-	-	-	- Average
	3	21	.175	30	-	-	15	-	-	-	- Best
T	4	28	.160	20	2	5	12	16	16	19	25 Best
	4	28	.160	20	1	2.7	5.4	9	10.5	12.5	19.7 Average
U	2	32	.160	20	2	4	5	8	12	16	27 Best
	2	32	.160	20	1.5	3	4	7.5	10.5	15	22.5 Average
V	2	32	.160	20	1	5	7	11	16	16	28 Best
	2	32	.160	20	.5	4	8	10.5	14	15	28.5 Average
O	3	21	.175	30	-	17	17	17	17	17	17 Average
	3	21	.175	30	-	17	17	17	17	17	17 Best

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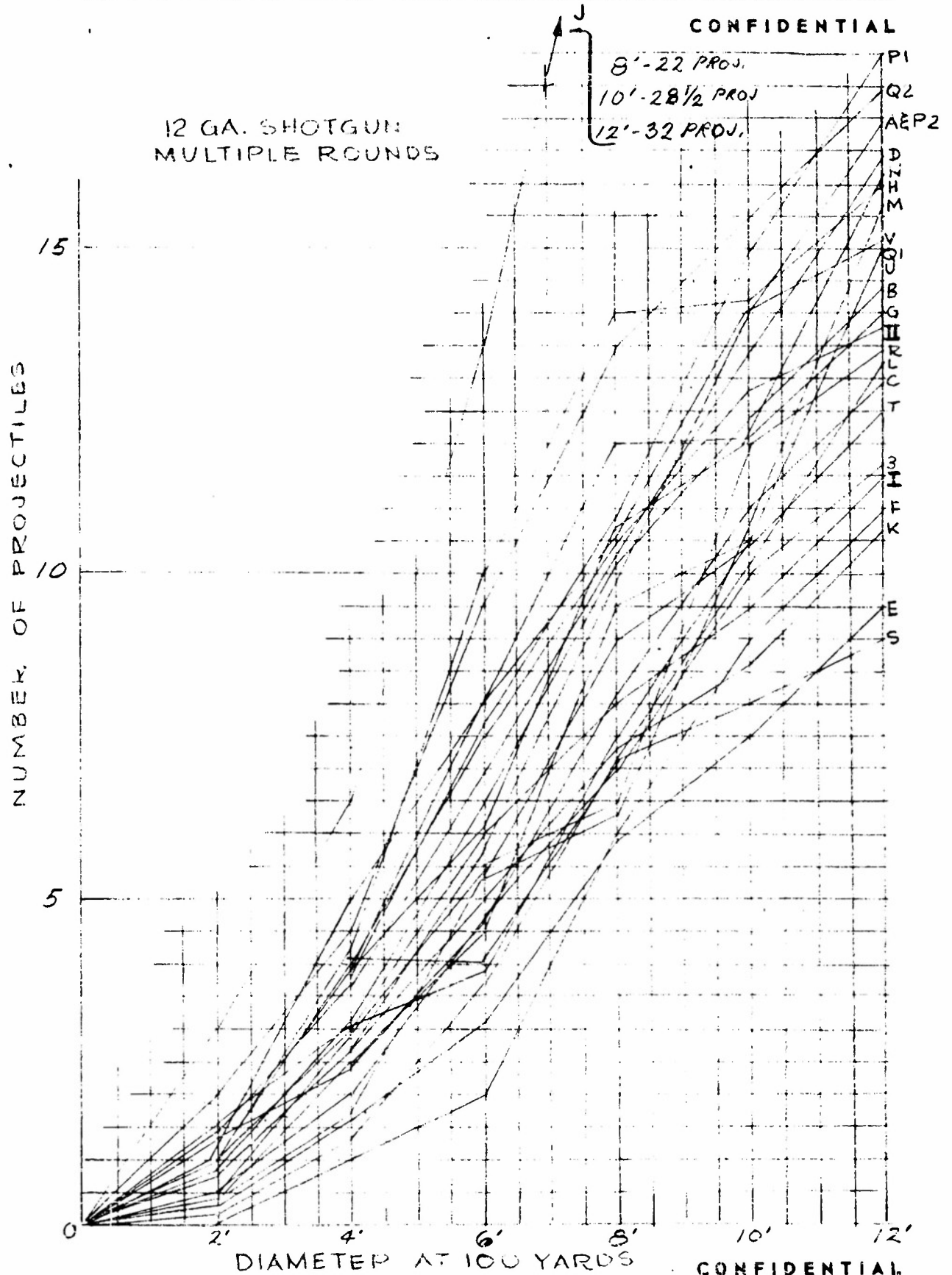
12 Gauge Shotgun

Number Round Type	Number Rounds Fired	Number Projectiles/Proto- Round Type	Fin Span	Fin Cent	Number of Projectiles in Diameter					Total Remarks	
					2 ft.	4 ft.	6 ft.	8 ft.	10 ft.		12 ft.
D	12	32	.160	2°	1.4	3.7	6.9	10.2	13.4	16.4	25 Average (Torn)
	12	32	.160	2°	4	8	17	26	29	32	32 Best at 50 yds.
	12	32	.160	2°	3	9	19	23	25	27	31 Best at 100 yds.
F	1	32	.160	2°	0	1	2	6	9	11	13 Average Best (Torn)
	1	32	.160	2°	0	1	2	6	9	11	13 Average Best (Torn)
G	1	32	.160	2°	1	5	8	12	12	14	14 Average Best (Torn)
	1	32	.160	2°	1	5	8	12	12	14	14 Average Best (Torn)
H	1	32	.160	2°	1	4	10	14	14	16	18 Average Best (Torn)
	1	32	.160	2°	1	4	10	14	14	16	18 Average Best (Torn)
J	2	32	.160	2°	3	6.5	13.5	22	28.5	32	32 Average Best at 50 yds.
	2	32	.160	2°	4	9	16	26	32	32	32 Average Best at 50 yds.
K	3	32	.160	2°	.4	2.7	5	7.3	8.6	10.7	20.7 Average Best
	3	32	.160	2°	0	3	5	9	10	11	22 Average Best
L	6	32	.160	2°	.2	1.3	3.7	7.2	10.2	13.5	22.2 Average Best
	6	32	.160	2°	1	5	10	12	18	21	26 Average Best
M	3	32	.160	2°	.3	1.7	5.3	6.3	11.7	15.7	24 Average Best (Torn)
	3	32	.160	2°	1	3	9	13	15	20	27 Average Best (Torn)
N	3	32	.160	2°	1	4	6	10.7	12	16	26.3 Average Best
	3	32	.160	2°	1	3	8	13	14	21	27 Average Best
P	9	32	.160	2°	1	3.8	7.7	10.8	15.0	18.0	31 Average Best
I	9	32	.160	2°	3	7	11	16	18	24	31 Average Best

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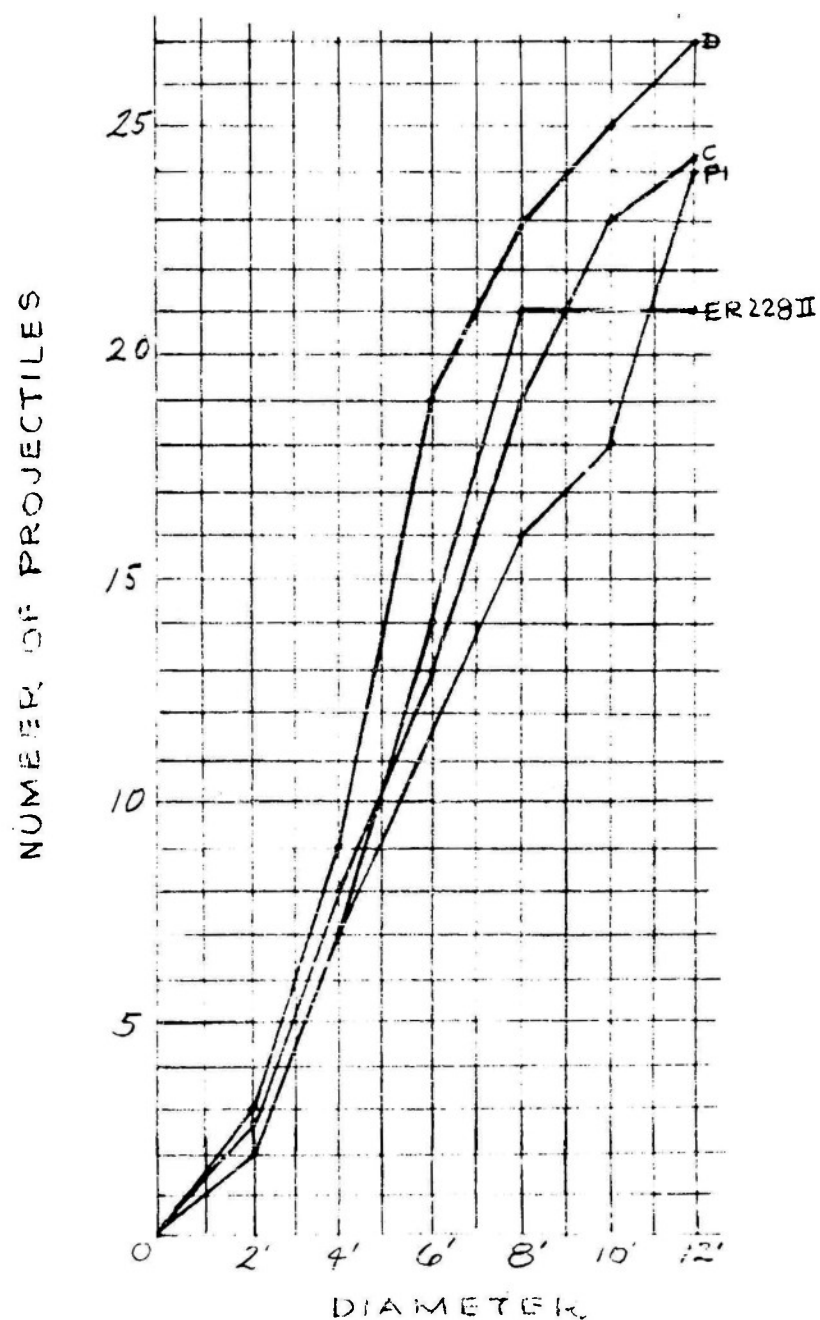
12 GA. SHOTGUN:
MULTIPLE ROUNDS



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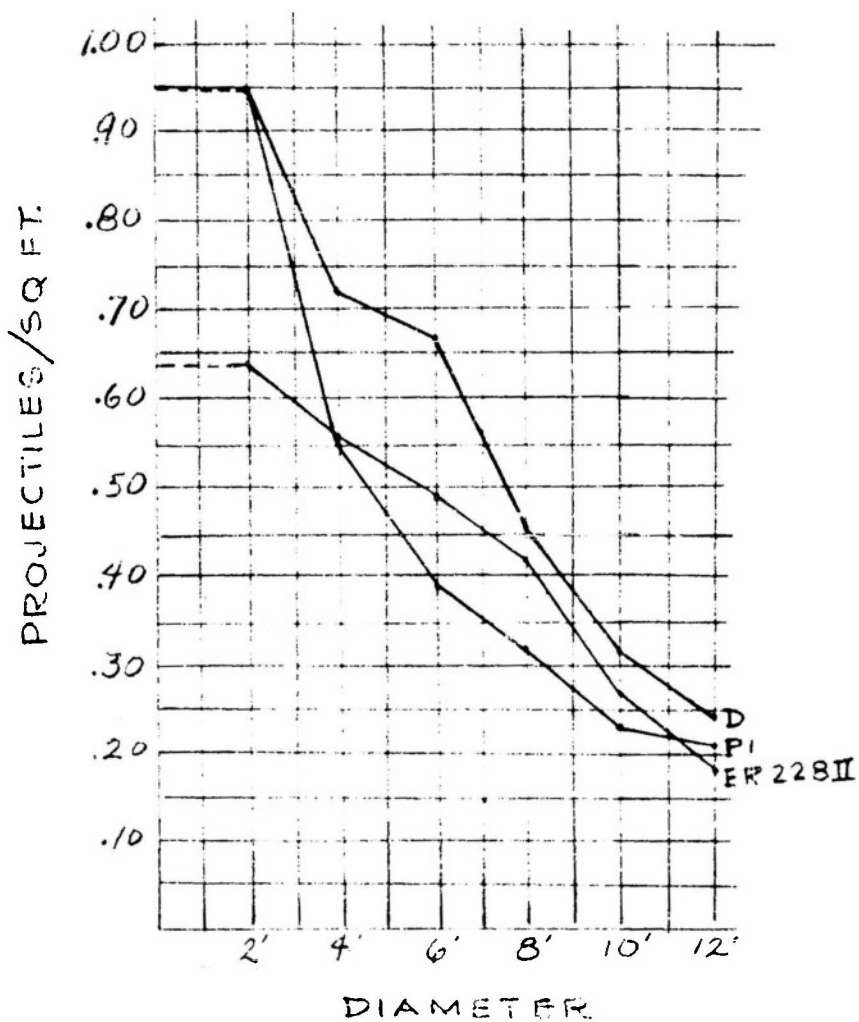
12 GAUGE SHOTGUN MULTIPLE ROUNDS
AT 100 YARDS
(BEST SINGLE ROUND OF EACH TYPE)



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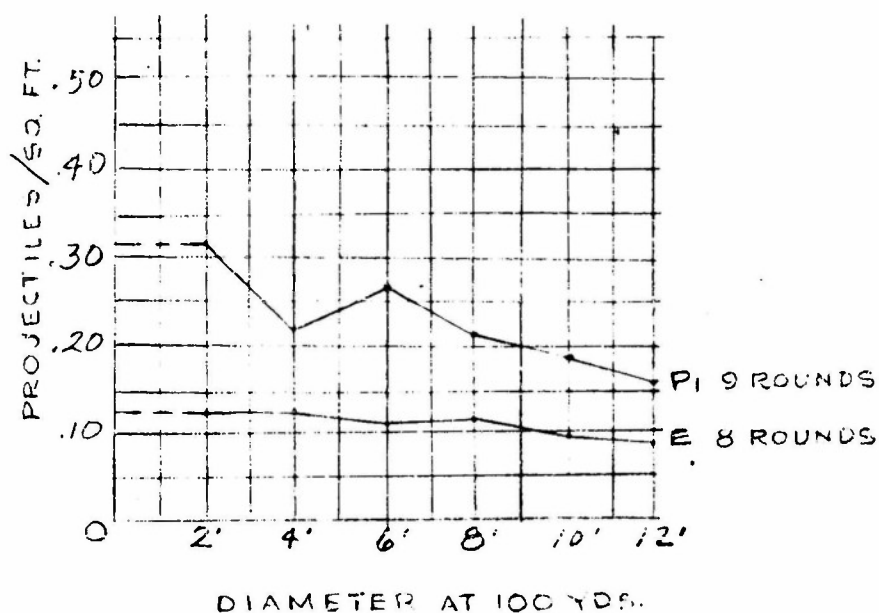
12 GAUGE SHOTGUN MULTIPLE ROUNDS
AT 100 YARDS
(BEST SINGLE ROUND OF EACH TYPE)



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12 GA. SHOTGUN MULTIPLE ROUNDS @ 100 YARDS
BEST AND WORST OF ALL TYPES
BASED ON LARGEST NUMBER OF ROUNDS FIRED



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The following conclusions are drawn as a result of the work under the subject contract during the past year:

1. Work to date indicates that scatter type ammunition is feasible and can be developed into a tactical ammunition. Additional data is required to establish the limitations of such possibility.
2. Additional investigations are required to establish:
 - a. Lethality characteristics.
 - b. Means to increase lethality of multiple rounds.
 - c. Detail design of ammunition.
 - d. Repeatability.
 - e. Proper sabot separation.
 - f. Lower costs of manufacturing components.
 - g. Better manufacturing technique.

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VI FUTURE PROGRAM

It is currently planned that the future program for the year 1954 will be as follows:

A. Establishment of Ammunition Criteria

1. Analysis of required performance.
2. Comparison with existing weapons.

B. Shotgun

1. Single Projectiles

- a. Engineering design.
- b. Manufacture of test articles.
- c. Preliminary tests.
- d. Determination of characteristics at the Naval Ordnance Laboratory.
- e. Lethality studies at the Army Chemical Center.

2. Multiple Rounds

- a. Engineering design.
- b. Manufacture of test articles.
- c. Preliminary tests.
- d. Determination of sabot breakaway characteristics at the Naval Ordnance Laboratory.
- e. Lethality studies at the Army Chemical Center.

C. 20 MM

Same as B.1.c, B.1.d and B.1.e above.

D. Summary Reports

1 July 1954 and 31 December 1954.

CONFIDENTIAL

CONFIDENTIAL**VII. REFERENCES**

Reference: (a) NAVORD Report No. 2778, dated 10 February 1953,
"A Free Flight Range Investigation to Determine
the Stability Characteristics of Individual
Scatter-Type Projectiles".

(b) AIRCRAFT ARMAMENTS, INC. Report No. ER-137,
dated 30 June 1952, "Research on Operational
Feasibility of Scatter-Type Projectiles".

(c) NAVORD Report No. 2893, dated 9 June 1953,
"Photographic Study of Sabot Separation of
Scatter Projectile Clusters".

CONFIDENTIAL



PAGE NO. 40

REPORT NO. ER-365

CONFIDENTIAL

VIII. APPENDIX

CONFIDENTIAL

CONFIDENTIAL

SINGLE PROJECTILES

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
1	.079	2.25	Delta	.109	Not Available	Not Available	
2	"	2.25	"	.114	"	"	
3	"	2.24	"	.117	"	"	
4	"	2.38	"	.144	"	"	
5	"	2.38	"	.147	"	"	
6	"	2.20	"	.150	"	"	
7	"	2.20	"	.150	"	"	
8	"	2.06	"	.108	"	"	
9	"	2.38	"	.123	"	"	
10	"	2.26	Rect. Length	.113	"	"	
11	"	2.26	"	.312	"	"	
12	"	2.34	"	.319	"	"	
13	"	2.25	"	.317	"	"	
14	"	2.25	"	.250	"	"	
15	"	1.92	"	.140	"	"	
16	"	2.38	"	.250	"	"	3 fins
17	"	"	"	.250	"	"	
18	"	"	"	.164	"	"	
19	"	"	"	.312	"	"	
20	"	2.25	"	.250	"	"	
21	"	2.25	"	.250	"	"	
22	"	2.06	"	.265	"	"	
23	"	"	"	.180	"	"	
24	"	"	"	.197	"	"	
25	"	"	"	.167	"	"	
26	"	"	"	.177	"	"	
27	.085	"	"	.285	"	"	
28	"	"	"	"	"	"	
29	"	"	"	"	"	"	
30	"	"	"	"	"	"	
31	"	"	Delta	.170	"	"	fired into cotton waste
32	No Record	No Record	Rect.	.217	5 in.	100 ft.	
33	"	"	Delta	.168	"	"	
34	"	"	Delta	.171	"	"	
35	"	"	Rect.	.214	7 in.	100 yd.	
36	"	"	"	.203	6 in.	100 yd.	
37	"	"	"	.215	11.5 in.	50 yd.	
38	"	"	"	.206	10 in.	100 ft.	
39	"	"	"	.216	8 in.	200 ft.	
40	"	"	"	.211	10 in.	75 ft.	

CONFIDENTIAL



PAGE NO. 42
REPORT NO. ER-365

SINGLE PROJECTILES (con't.)

CONFIDENTIAL

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
41	No Record	No Record	Rect.	.209	15 in.	50 yd.	
42	"	"	"	.214	6 in.	50 ft.	
43	"	"	"	.213	2 in.	100 yd.	
44	"	"	"	.220	11 in.	200 ft.	
45	"	"	"	.211	6 in.	50 ft.	
46	"	"	"	.227	6 in.	100 yd.	
47	"	"	"	.211	7 in.	125 ft.	
48	"	"	"	.209	9 in.	75 ft.	
49	"	"	"	.210	12 in.	50 yd.	
50	"	"	"	.203	8 in.	50 ft.	
51	"	"	"	.174	10 in.	100 ft.	
52	"	"	"	.175	8 in.	75 ft.	
53	"	"	"	.173	11 in.	100 ft.	
54	"	"	"	.175	12 in.	50 yd.	
55	"	"	"	.175	11 in.	100 ft.	
56	.088	2.06	7° twisted	.200	3 in.	100 yd.	short chamfer
57	"	"	"	"	17.5 in.	"	"
58	"	"	"	"	2 in.	"	"
59	"	"	"	"	1.5 in.	"	long chamfer
60	"	"	"	"	6 in.	"	"
61	"	"	"	"	2 in.	"	"
62	"	"	straight	"	29 in.	"	
63	"	"	"	"	19 in.	"	
64	"	"	"	"	2 in.	200 ft.	lost at 100 yd.
65	"	"	"	"	19 in.	100 yd.	
66	"	"	"	"	42 in.	"	
67	"	"	7° twisted	"	12 in.	"	long chamfer
68	"	"	"	"	18 in.	"	"
69	"	"	"	"	17.5 in.	"	"
70	"	"	"	"	6 in.	"	"
71	"	"	"	"	3 in.	"	short chamfer
72	"	"	"	"	21.5 in.	"	"
73	"	"	"	"	28 in.	"	"
74	"	"	"	"	5 in.	"	long chamfer
75	"	"	"	"	8.5 in.	"	"
76	"	"	"	"	8 in.	"	"
77	"	"	"	"	7 in.	"	"
78	"	"	"	"	4.5 in.	"	"
79	"	"	"	"	5.5 in.	"	"
80	"	"	"	"	2.5 in.	"	"
81	"	"	"	"	14.5 in.	"	"
82	"	"	"	"	7 in.	"	"
83	"	"	"	"	9 in.	"	"
84	"	"	"	"	37.5 in.	"	"
85	"	"	"	"	11.5 in.	"	"

CONFIDENTIAL

SINGLE PROJECTILES (con't.)

CONFIDENTIAL

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
86	.088	2.06	7° twisted	.200	14 in.	100 yd.	long chamfer
87	"	"	"	"	5.5 in.	"	"
88	"	"	"	"	23 in.	"	"
89	"	"	"	"	8 in.	"	"
90	"	"	"	"	18 in.	"	"
91	"	"	"	"	9 in.	"	"
92	"	"	"	"	7 in.	"	"
93	"	"	"	"	5 in.	"	"
94	"	"	"	"	10.5 in.	"	"
95	"	"	"	"	8 in.	"	"
96	"	"	"	"	2.5 in.	"	"
97	"	"	"	"	14 in.	"	short chamfer
98	"	"	"	"	4 in.	"	"
99	"	"	"	"	13 in.	"	"
100	"	"	"	"	25 in.	200 ft.	lost at 100 yd.
101	"	"	"	"	5 in.	100 yd.	short chamfer
102	"	"	3° formed	"	13.5 in.	"	"
103	"	"	"	"	9 in.	"	"
104	"	"	"	"	18 in.	"	"
105	"	"	"	"	20 in.	"	"
106	"	"	"	"	7 in.	"	"
107	"	"	"	"	3 in.	"	"
108	"	"	"	"	13 in.	"	"
109	"	"	"	"	7 in.	"	"
110	"	"	"	"	7 in.	"	"
111	"	"	"	"	15.5 in.	100 ft.	lost at 200 ft.
112	"	"	7° extra long	"	22.5 in.	200 ft.	lost at 100 yd.
113	"	"	"	"	6 in.	100 yd.	"
114	"	"	"	"	22.5 in.	"	"
115	"	"	"	"	16 in.	"	"
116	"	"	7° formed	"	5 in.	200 ft.	lost at 100 yd.
117	"	"	"	"	5 in.	100 ft.	lost at 200 ft.
118	"	"	"	"	29 in.	100 yd.	"
119	"	"	3° formed	"	3.5 in.	"	"
120	"	"	"	"	4 in.	"	"
121	"	"	"	"	5 in.	"	"
122	"	"	"	"	13 in.	"	"
123	"	"	"	"	9.5 in.	"	"
124	"	"	"	"	10 in.	"	"
125	"	"	"	"	7 in.	"	"

CONFIDENTIAL

SINGLE PROJECTILES (con't.)

CONFIDENTIAL

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
126	.088	7.06	3° formed	.200	8 in.	100 yd.	
127	"	"	"	"	10 in.	"	
128	"	"	"	"	18.5 in.	"	
129	"	"	"	"	14.5 in.	"	blunt nose
130	"	"	"	"	8.5 in.	"	"
131	"	"	"	"	6 in.	"	"
132	"	"	7° formed	"	24 in.	"	
133	"	"	"	"	10.5 in.	"	
134	"	"	"	"	11 in.	"	
135	"	"	"	"	7 in.	"	
136	"	"	"	"	7 in.	"	
137	"	"	"	"	3 in.	"	
138	"	"	"	"	20 in.	"	
139	"	"	"	"	10.5 in.	"	
140	"	"	"	"	5 in.	"	blunt nose
141	"	"	"	"	15.5 in.	"	"
142	"	"	"	"	13.5 in.	"	"
143	"	"	"	"	7.5 in.	"	"
144	"	"	"	"	8 in.	"	"
145	"	"	3° as formed	.200	1.5 in.	"	1060 stl. HT. 190,000 psi
146	"	"	"	"	1.5 in.	"	"
147	"	"	"	"	1 in.	"	"
148	"	"	"	"	5 in.	"	"
149	"	"	"	"	4.5 in.	"	"
150	"	"	"	"	8.5 in.	"	"
151	"	"	"	"	3 in.	"	"
152	"	"	"	"	4.5 in.	"	"
153	"	"	"	"	5 in.	"	"
154	"	"	"	"	13 in.	"	"
155	"	"	"	"	22.5 in.	"	"
156	"	"	3° as formed	.200	4.5 in.	285 ft.	"
157	"	"	"	"	4.5 in.	"	"
158	"	"	"	"	5.5 in.	"	"
159	"	"	"	"	14.5 in.	"	"
160	"	"	"	"	11 in.	"	"
161	"	"	"	"	4.6 in.	250 ft.	"
162	"	"	"	"	1.5 in.	"	"
163	"	"	"	"	6 in.	"	"
164	"	"	"	"	8 in.	"	"
165	"	"	"	"	16.5 in.	"	"

CONFIDENTIAL



PAGE NO. 45
REPORT NO. ER-365

CONFIDENTIAL

SINGLE PROJECTILES (con't.)

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
166	.088	2.06	3° formed	.200	2 in.	200 ft.	1060 stl. HT. 190,000 psi
167	"	"	"	"	2 in.	"	"
168	"	"	"	"	5.5 in.	"	"
169	"	"	"	"	8.5 in.	"	"
170	"	"	"	"	11. in.	"	"
171	"	"	"	"	4.5 in.	150 ft.	"
172	"	"	"	"	3 in.	"	"
173	"	"	"	"	1.5 in.	"	"
174	"	"	"	"	1 in.	"	"
175	"	"	"	"	12.5 in.	"	"
176	"	"	"	"	2 in.	100 ft.	"
177	"	"	"	"	2 in.	"	"
178	"	"	"	"	4.5 in.	"	"
179	"	"	"	"	5.5 in.	"	"
180	"	"	"	"	3 in.	"	"
181	"	"	"	"	3 in.	50 ft.	"
182	"	"	"	"	3.5 in.	"	"
183	"	"	"	"	3.8 in.	"	"
184	"	"	"	"	5 in.	"	"
185	"	"	"	"	5.5 in.	"	"
186	"	"	"	.180	9 in.	285 ft.	"
187	"	"	"	"	9 in.	"	"
188	"	"	"	"	11 in.	"	"
189	"	"	"	"	8 in.	"	"
190	"	"	"	"	13.5 in.	"	"
191	"	"	"	"	3 in.	250 ft.	"
192	"	"	"	"	6 in.	"	"
193	"	"	"	"	4 in.	"	"
194	"	"	"	"	3 in.	"	"
195	"	"	"	"	7.5 in.	"	"
196	"	"	"	"	6 in.	200 ft.	"
197	"	"	"	"	11 in.	"	"
198	"	"	"	"	2.5 in.	"	"
199	"	"	"	"	4.5 in.	"	"
200	"	"	"	"	10 in.	"	"
201	"	"	"	"	9 in.	150 ft.	"
202	"	"	"	"	0.6 in.	"	"
203	"	"	"	"	4 in.	"	"
204	"	"	"	"	4 in.	"	"
205	"	"	"	"	6 in.	"	"

CONFIDENTIAL

CONFIDENTIAL

SINGLE PROJECTILES (cont.)

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
206	.088	2.06	3° formed	.180	3.5 in.	100 ft.	1060 stl. HT. 190,000 psi
207	"	"	"	"	2.5 in.	"	"
208	"	"	"	"	3.5 in.	"	"
209	"	"	"	"	6.7 in.	"	"
210	"	"	"	"	8 in.	"	"
211	"	1.50	"	.175	7 in.	100 yd.	"
212	"	"	"	"	5 in.	"	"
213	"	"	"	"	7 in.	"	"
214	"	"	"	"	7 in.	"	"
215	"	"	"	"	3.5 in.	"	"
216	"	"	"	"	9 in.	"	"
217	"	"	"	"	4.5 in.	"	"
218	"	"	"	"	8.5 in.	"	"
219	"	"	"	"	8 in.	"	"
220	"	"	"	"	17 in.	"	"
#221 to #230 - NO RECORD							
231	.088	1.50	2° formed	.175	4.5 in.	100 yd.	1060 stl. HT. 190,000 psi
232	"	"	"	"	1.5 in.	"	"
233	"	"	"	"	3.5 in.	"	"
234	"	"	"	"	11 in.	"	"
235	"	"	"	"	7 in.	"	"
236	"	"	"	"	8 in.	"	"
237	"	"	"	"	8 in.	"	"
238	"	"	"	"	6 in.	"	"
239	"	"	"	"	4 in.	"	"
240	"	"	"	"	5.5 in.	"	"
241	"	"	"	"	21 in.	"	"
242	"	"	"	"	11 in.	"	"
243	"	"	"	"	5.5 in.	"	"
244	"	"	"	"	6 in.	"	"
245	"	"	"	"	5 in.	"	"
246	"	"	"	"	7 in.	"	"
247	"	"	"	"	1 in.	"	"
248	"	"	"	"	1 in.	"	"
249	"	"	"	"	1.5 in.	"	"
250	"	"	"	"	2 in.	"	"
251	"	"	1° formed	"	5 in.	"	"
252	"	"	"	"	1 in.	"	"
253	"	"	"	"	1.5 in.	"	"
254	"	"	"	"	1.3 in.	"	"
255	"	"	"	"	2 in.	"	"

CONFIDENTIAL

CONFIDENTIAL

SINGLE PROJECTILES (con't.)

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Sightsight	Range	Remarks
256	.088	1.50	1° formed	.175	3 in.	100 yd.	1060 stl. HT. 190,000 psi
257	"	"	"	"	1 in.	"	"
258	"	"	"	"	9 in.	"	"
259	"	"	"	"	1 in.	"	"
260	"	"	"	"	No Record	"	"
#261 to #270 - NO RECORD							
271	.088	2.06	3° formed	.200	6.5 in.	100 yd.	1060 stl. HT. 190,000 psi
272	"	"	"	"	2 in.	"	"
273	"	"	"	"	12 in.	"	"
274	"	"	"	"	16.5 in.	"	"
275	"	"	"	"	3 in.	"	"
276	"	"	"	"	3 in.	"	"
277	"	"	"	"	5.5 in.	"	"
278	"	"	"	"	28 in.	"	"
279	"	"	"	"	8 in.	"	"
280	"	"	"	"	3.5 in.	"	"
281	"	"	2° formed	"	3 in.	"	"
282	"	"	"	"	8 in.	"	"
283	"	"	"	"	7 in.	"	"
284	"	"	"	"	2 in.	"	"
285	"	"	"	"	2 in.	"	"
286	"	"	"	"	2 in.	"	"
287	"	"	"	"	4 in.	"	"
288	"	"	"	"	3.5 in.	"	"
289	"	"	"	"	8.5 in.	"	"
290	"	"	"	"	3 in.	"	"
#291 to #320 - NO RECORD							
321	.088	2.06	1° formed	.200	8 in.	100 yd.	1060 stl. HT. 190,000 psi
322	"	"	"	"	No Record	"	"
323	"	"	"	"	8 in.	"	"
324	"	"	"	"	No Record	"	"
325	"	"	"	"	6 in.	"	"
326	"	"	"	"	3.5 in.	"	"
327	"	"	"	"	9 in.	"	"
328	"	"	"	"	2 in.	"	"
329	"	"	"	"	5.5 in.	"	"
330	"	"	"	"	3 in.	"	"
331	"	"	"	"	No Record	"	"
332	"	"	"	"	3.5 in.	"	"
333	"	"	"	"	5.5 in.	"	"
334	"	"	"	"	8 in.	"	"
335	"	"	"	"	8 in.	"	"

CONFIDENTIAL



PAGE NO. 48
REPORT NO. ER-365

SINGLE PROJECTILE (con't.)

CONFIDENTIAL

Round Number	Diameter	Projectile Length	Type of Fin	Fin Span	Distance Off Boresight	Range	Remarks
336	.088	2.06	1° formed	.200	3.5 in.	100 yd.	1060 stl. HT. 190,000 psi
337	"	"	"	"	10.5 in.	"	"
338	"	"	"	"	11.5 in.	"	"
339	"	"	"	"	No Record	"	"
340	"	"	"	"	No Record	"	"
341	"	"	2° canted Delta	.195	2 in.	"	"
342	"	"	"	"	2.5 in.	"	"
343	"	"	"	"	4 in.	"	"
344	"	"	"	"	1.5 in.	"	"
345	"	"	"	"	4.5 in.	"	"
346	"	"	"	"	0.2 in.	"	"
347	"	"	"	"	1 in.	"	"
348	"	"	"	"	4.5 in.	"	"
349	"	1.50	2° formed	.160	0.5 in.	"	"
350	"	"	"	"	4 in.	"	"
351	"	"	"	"	5 in.	"	"
352	"	"	"	"	3.5 in.	"	"
353	"	"	"	"	3 in.	"	"
354	"	"	"	"	2.5 in.	"	"
355	"	"	"	"	9 in.	"	"
356	"	"	"	"	9.5 in.	"	"
357	"	"	"	.150	4 in.	"	"
358	"	"	"	"	11.5 in.	"	"
359	"	"	"	"	3.5 in.	"	"
360	"	"	"	"	5.5 in.	"	"
361	"	"	"	"	11 in.	"	"
362	"	"	"	"	4 in.	"	"
363	"	"	"	"	1 in.	"	"
364	"	"	"	"	8 in.	"	"
365	"	"	"	"	7.5 in.	"	"
366	"	"	"	.140	7 in.	"	"
367	"	"	"	"	6 in.	"	"
368	"	"	"	"	4 in.	"	"
369	"	"	"	"	6 in.	"	"
370	"	"	"	"	2.5 in.	"	"
371	"	"	"	"	1 in.	"	"
372	"	"	"	"	6 in.	"	"
373	"	"	"	"	14.5 in.	"	"
374	"	"	"	"	12 in.	"	"

CONFIDENTIAL



PAGE NO. 49
REPORT NO. ER-365

CONFIDENTIAL

20 MM ROUNDS										Per- cent Per- Hits Range cent 12 ft Yards Hits Diam.	Type of Round	Total 12 ft Total	Hits in Diameter 2 ft 4 ft 6 ft 8 ft 10 ft 12 ft	Type of Projectile Cant Angle	Length Span	Number of Fro- jectiles in Round	Round Weight Grains	Number	Report Page No.
1	2	3	4	5	6	7	8	9	10										
1	1595	None																	ER-137 p.31
2	941	36	4							50	4								"
3	1390	32								75	2								"
4	1755	16								75	1								"
5	860	32								75	0								"
6	1180	16								100	1								"
7	865	32								100	2								"
8	890	16								100	0								"
9	1174	16								100	1								"
10	1025	16	16							20	16								"
11	789	16	15							20	15								"
12		21								100	15								ER-137D p.50
13		21								100	6								"
14		21	3							100	3								"
15		21	3							100	3								"
16		21								100	8								"
17		21	10							100	10								"
18		21								100	6								"
19		21								100	12								"
20		21								100	5								"
21		21								100	4								"
22		21	5							100	5								"
23		21								100	18								ER-137G p.8
24		33	0							100	7								

CONFIDENTIAL



PAGE NO. 50
REPORT NO. ER-365

CONFIDENTIAL

20 MM ROUNDS										Type of Round	Total Hits	Per cent Hits	Report Page No.
Round Number	Weight of Projectile	Grains in Round	Span	Angle	Length	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	100	
25	21		.180	2°		0	0	1	1	2	5	8	ER-1373 p.8
26	"		"	"		2	2	4	9	11	13	38	"
27	"		"	"		0	1	2	3	3	4	62	"
28	"		"	"		2	3	7	7	9	13	52	"
29	"		"	"		1	5	7	12	13	15	71	"
30	"		"	"		3	7	10	15	17	19	86	"
31	"		"	"		0	2	5	7	12	14	95	"
32	"		.197	"		1	5	8	15	17	17	90	"
33	"		"	"		2	3	5	11	14	16	81	ER-1371 p.20
34	"		"	"		0	2	6	9	13	14	67	p.21
35	"		"	"		0	1	3	5	10	11	62	p.22
36	"		"	"		0	4	6	5	11	14	52	p.23
37	"		"	"		3	5	11	14	18	21	67	p.24
38	"		"	"		1	5	9	12	15	18	86	p.25
39	"		"	"		3	6	11	13	16	19	71	p.26
40	"		"	"		1	4	9	11	15	17	90	p.27
41	"		"	"		0	2	5	9	14	17	81	ER-137G p.6
42	"		"	"		0	0	1	3	6	8	67	"
43	"		"	"		4	5	7	12	17	18	57	"
44	"		"	"		1	6	9	13	15	17	86	"
45	"		"	"		1	1	4	9	9	9	90	"
46	"		"	"		0	3	5	7	11	11	48	"
47	"		"	"		0	1	3	7	11	13	62	"
48	"		"	"		1	6	10	12	15	18	57	"
49	"		"	"		0	4	6	9	14	16	86	"
50	"		"	"		2	5	9	11	14	15	76	"
51	"		"	"		0	4	7	11	15	16	81	"
52	"		"	"		2	3	7	11	14	16	81	"
53	"		"	"		3	10	13	16	18	19	90	"
54	42	2040	1.50L	2°		1	4	5	7	14	18	60	ER-137G p.4
55	"	"	.175S	"		1	2	6	11	14	18	43	"
56	"	"	"	"		0	0	6	9	12	16	57	"
57	"	"	"	"		0	1	3	5	9	17	55	"
58	"	"	"	"		2	6	10	11	14	18	60	"
												64	"
												43	"

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20 MM ROUNDS										Type of Round	Total Hits	Per cent Hits	Report Page No.
Round Number	Weight in Pounds	Type of Projectile	Length in Inches	Span	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft			
59	21	20	2.06L	0	1	1	1	1	1	3	8	11	38 Aug. '53
60	21	20	.200S	1	3	8	10	13	14	14	14	67	p.6
61	"	"	"	2	7	9	14	18	20	21	21	95	"
62	"	"	"	0	6	9	10	13	14	15	15	67	"
63	"	"	"	3	5	9	11	12	15	18	18	71	"
64	"	"	"	5	8	11	14	15	17	18	19	81	"
65	"	"	"	2	4	7	12	14	17	19	19	81	"
66	"	"	"	0	6	8	14	17	17	19	19	81	"
67	"	"	"	2	5	7	9	11	14	16	16	67	"
68	"	"	"	3	5	10	12	14	16	19	19	76	"
69	"	"	"	3	8	13	17	18	18	18	18	86	p.7
70	"	"	"	0	0	1	3	5	6	9	9	29	"
71	"	"	"	1	1	2	5	6	7	11	11	33	"
72	"	"	"	1	5	7	8	11	15	15	15	71	"
73	"	"	"	0	0	1	2	4	16	16	16	76	"
74	"	"	"	0	2	2	6	9	12	19	19	57	Sept. '53
75	"	"	"	2	8	10	12	12	15	18	18	71	p.12
76	"	"	"	2	5	9	12	15	16	20	20	76	"
77	"	"	"	0	4	5	6	10	15	19	19	71	"
78	"	"	"	1	5	7	9	14	16	21	21	76	"
79	"	"	"	3	7	11	12	13	16	21	21	76	"
80	"	"	"	1	5	7	7	11	15	20	20	71	"
81	"	"	"	0	0	0	0	2	2	2	2	9	"
82	"	"	"	3	5	7	8	11	15	21	21	71	"
83	"	"	"	2	3	5	8	9	10	15	15	43	"
84	"	"	"	2	2	2	3	5	9	13	13	43	Oct. '53
85	"	"	"	0	1	1	1	3	3	7	7	14	p.6
86	"	"	"	0	1	3	3	5	5	8	8	24	"
87	"	"	"	0	0	4	7	9	11	14	14	52	"
88	"	"	"	0	0	2	4	4	5	11	11	24	"
89	"	"	"	0	3	5	8	10	14	20	20	67	"
90	"	"	"	1	4	9	13	17	18	21	21	86	"

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20 MA ROUNDS																	
Round Number	Weight Grains	Number of Projectiles	Type of Projectile	Cant Angle	Length Span	Hits in Diameter						Total	Type of Round	Range Yards	Per-Hits cent 12 ft Diam.	Per-Hits cent 12 ft Diam.	Report Page No.
						2 ft	4 ft	6 ft	8 ft	10 ft	12 ft						
91		21	2°	2.06	3	6	9	11	12	17	21	XVIII	100	100	81	Oct. '53	
92		21	20	2.00	1	1	1	3	6	7	21	XVIII	100	100	33	p. 6	
93	1959	32	20L 10S	2.00	1	2	8	15	19	21	27	XV	100	84	66	Dec. '53	
94	1994	32	"	2.00	4	5	6	9	13	13	25	XV	100	73	56	"	
95	1994	32	"	2.00	2	8	12	16	19	21	28	XV	100	88	66	"	
96	1971	32	"	2.00	1	1	4	6	10	10	25	XV	100	78	31	"	
97	2012	32	"	2.00	0	2	10	14	17	18	27	XV	100	84	56	"	
98	1893	31	20	2.00	1	1	3	7	8	14	18	XVII	100	86	67	"	
99	1909	31	"	2.00	2	4	10	15	17	18	20	XVII	100	95	86	"	
100	1861	31	"	2.00	0	1	4	7	9	13	19	XVII	100	90	62	"	
101	1893	31	"	2.00	1	2	3	5	5	11	18	XVII	100	86	52	"	
102	1974	32	20L 10S	2.00	0	0	1	2	3	5	14	XVI	100	44	15	"	
												mod.					

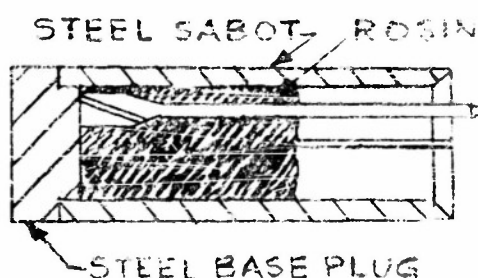
* Alternate projectiles with fins. .25 inch from Rear End.

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NO. 12 ROUNDS

ROUND TYPE-A



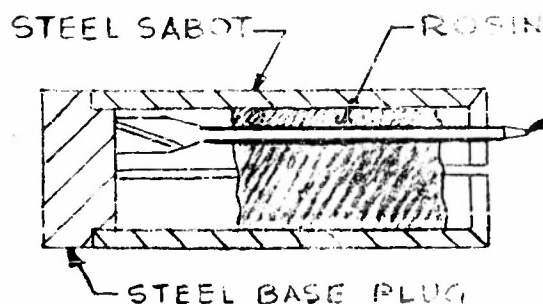
21 PROJECTILES
.180 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		58			
BEST ROUND		10			

TOTAL ROUNDS FIRED-6

ROUND TYPE-B



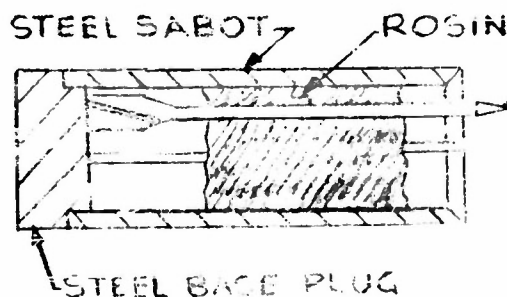
21 PROJECTILES
.199 TO .195 SPAN
3° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		63			
BEST ROUND		8			

TOTAL ROUNDS FIRED-3

ROUND TYPE-C



21 PROJECTILES
.199 TO .195 SPAN
3° FIN CANT
SLIGHTLY ECCENTRIC FIN.

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		7.2			
BEST ROUND		11			

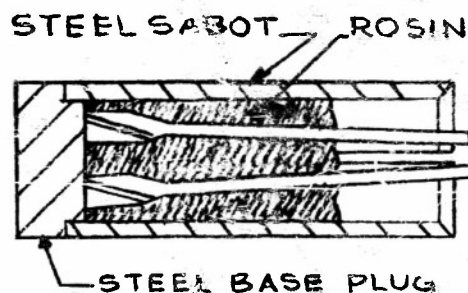
TOTAL ROUNDS FIRED-4

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20MM ROUNDS

ROUND TYPE - D



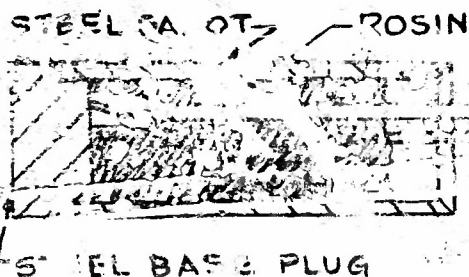
21 PROJECTILES
.197 SPAN
3° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			11		
BEST ROUND			11		

TOTAL ROUNDS FIRED - 1

ROUND TYPE - E



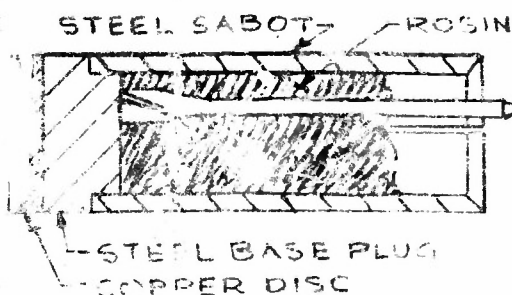
21 PROJECTILES
.97

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		5			
BEST ROUND			9		

TOTAL ROUNDS FIRED - 3

ROUND TYPE - F&G



21 PROJECTILES
.197 SPAN
FIN CANT
COPPER PLATED

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			76		
BEST ROUND			76		

TOTAL ROUNDS FIRED - 7

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ROUND TYPE - H

STEEL SAOT - ROSIN



STEEL BASE PLUG
COPPER DISC

TOTAL ROUNDS FIRED - 4

21 PROJECTILES
.07 SPAN
2 IN CASE

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15

ROUND TYPE - I

STEEL SAOT - STEEL PLUG



STEEL BASE PLUG
COPPER DISC

TOTAL ROUNDS FIRED - 5

42 PROJECTILES
.175 SPAN
2 IN CASE

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5

AVERAGE ROUND	5
BEST ROUND	5

ROUND TYPE - XI

STEEL SAOT

ROBIN



1ST BACK-UP WASHER
ALUMINUM BASE PLUG

TOTAL ROUNDS FIRED - 5

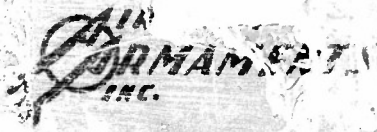
21 PROJECTILES
.200 SPAN
2 IN CASE

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10

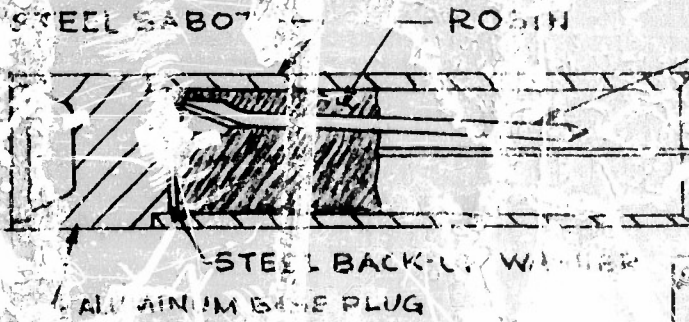
AVERAGE ROUND	7
BEST ROUND	9

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505
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ROUND TYPE - III

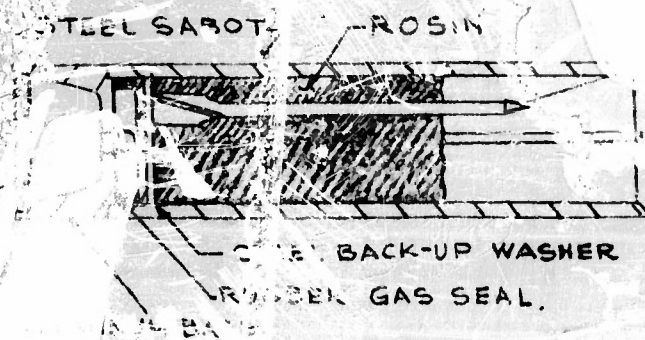


21 PROJECTILES
.200 GAU
20 PIN CANT

NO OF PR IN 6 FT. DIA	0	5	10	15	20
AVERAGE ROUND					
BEST ROUND					

TOTAL ROUNDS FIRED - 5

ROUND TYPE - IV



21 PROJECTILES
.200 GAU
20 PIN CANT

NO IN 6	0	5	10	15	20
AVERAGE ROUND					

TOTAL ROUNDS FIRED - 5

ROUND TYPE - V



AVERAGE ROUND					
BEST ROUND					

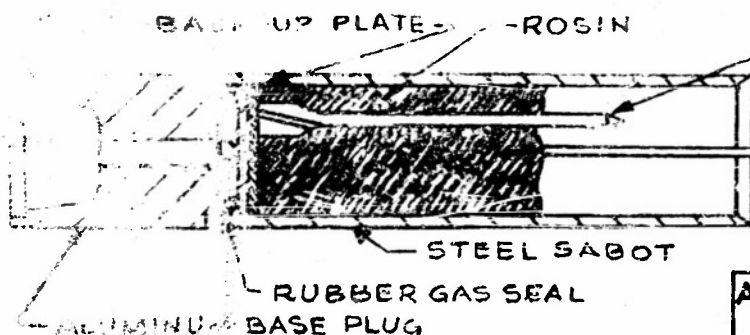
TOTAL ROUNDS FIRED - 5

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ROCKET ROUNDS

ROUND TYPE - III



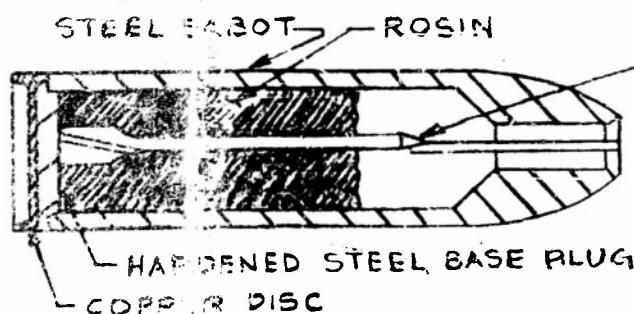
21 PROJECTILES
.200 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		6			
BEST ROUND			11		

TOTAL ROUNDS FIRED - 5

ROUND TYPE - VII



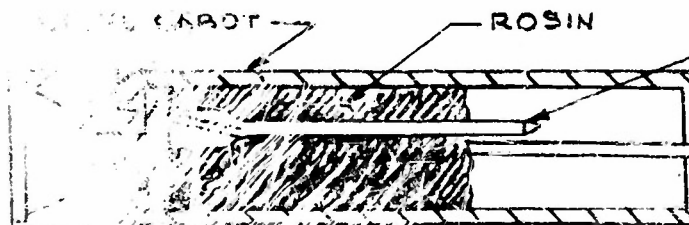
21 PROJECTILES
.200 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		25			
BEST ROUND		4			

TOTAL ROUNDS FIRED - 4

ROUND TYPE - XVIII



21 PROJECTILES
.200 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		5.1			
BEST ROUND			9		

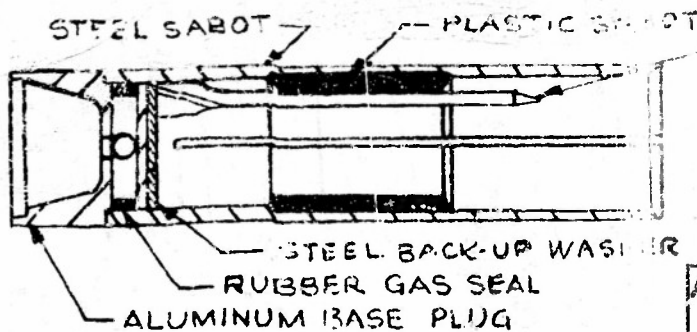
TOTAL ROUNDS FIRED - 5

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ROUND ROUNDS

ROUND TYPE-XV

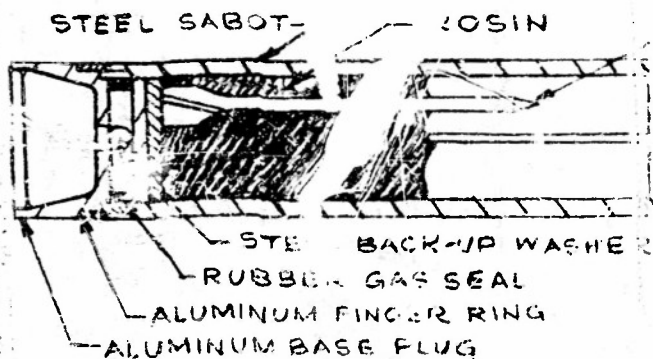


32 PROJECTILES
200 SPAN
20 FIN CANT

NO. OF PROJECTILES IN 6 IN. DIA. AT	ES YDS.		
	5	10	20
AVERAGE ROUND	8		
BEST ROUND	12		

TOTAL ROUNDS FIRED-5

ROUND TYPE-X



PROJECTILES
SPAN
CANT

PROJECTILES IN 6 IN. DIA. AT 100 YDS.	ES YDS.		
	10	15	20
AVERAGE ROUND			
BEST ROUND	10		

TOTAL ROUNDS FIRED-4

ROUND TYPE-

NO. OF PROJECTILES IN 6 IN. DIA. AT 100 YDS.	ES YDS.			
	5	10	15	20
AVERAGE ROUND				
BEST ROUND				

TOTAL ROUNDS FIRED-

CONFIDENTIAL

PAGE NO. 59
REPORT NO. ER-365

CONFIDENTIAL

Number	Weight (pounds)	Caliber	Angle	Range (ft)	4 ft	6 ft	8 ft	10 ft	12 ft	Total	Range	Hits	Per cent	Report
20	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
21	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
22	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
23	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
24	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
25	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
26	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
27	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
28	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
29	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
30	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
31	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
32	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
33	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
34	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
35	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
36	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
37	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
38	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
39	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
40	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
41	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
42	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
43	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
44	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228
45	21	12	0	100	6	9	12	15	18	50	ER228	100	100	ER137F p.5 or ER228

see ER137F, pg. 9, Type IIB
see ER228 with lead spacers

see ER137F, pg. 9, Type IIA
see ER137F, pg. 9, Type I

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12 GAUGE SHOTGUN												Per- cent	Per- cent	Report	
Round Number	Weight Grains	Pro- jectiles in Rounds	Type of Projectile		Hits in Diameter							Type of Round	Range Yards	Hits Diam.	Page No.
			Cant Angle	Length Span	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Total				
46	580	21	30	.175	0	1	6	9	12	13	15	ER228	100		ER238 or ER137H p.5
47	"	"	"	"	2	7	14	21	21	21	21	"	"	"	"
48	"	"	"	"	1	7	12	13	13	13	13	"	"	"	"
49	"	"	"	"	1	2	10	13	18	20	20	"	"	"	"
50	"	"	"	"	0	2	3	4	7	7	7	"	"	"	"
51	"	"	"	"	1	2	4	7	9	11	11	"	"	"	"
52	"	"	"	"	2	4	10	13	14	17	17	"	"	"	"
53	"	"	"	"	3	7	10	14	18	20	20	"	"	"	"
54	"	"	"	"	0	4	7	10	13	13	13	"	"	"	"
55	"	"	"	"	0	1	4	7	9	12	13	"	"	"	"
56	"	"	"	"	0	5	8	10	13	13	14	"	"	"	"
57	"	"	"	"	2	6	8	11	13	15	15	"	"	"	"
58	"	"	"	"	1	3	5	8	13	13	13	"	"	"	"
59	"	"	"	"	1	4	10	12	14	15	16	"	"	"	"
60	"	"	"	"	0	1	3	6	10	14	16	"	"	"	"
61	"	"	"	"	4	7	12	19	21	21	21	"	"	"	"
62	"	"	"	"	0	4	8	14	15	18	18	"	"	"	"
63	"	"	"	"	1	5	13	15	18	18	19	"	"	"	"
64	"	"	"	"	1	4	4	4	7	9	11	"	"	"	"
65	"	"	"	"	0	1	1	4	5	5	5	"	"	"	"
66	"	"	"	"	0	2	4	4	4	5	5	"	"	"	"
67	"	"	"	"	1	1	3	4	5	8	9	"	"	"	"
68	"	"	"	"	2	2	5	8	12	12	17	"	"	"	"
69	"	"	"	"	2	4	9	14	17	18	18	"	"	"	"
70	"	"	"	"	1	2	5	3	9	11	12	"	"	"	"
71	"	"	"	"	1	4	10	13	14	15	15	"	"	"	"
72	"	"	"	"	1	3	4	4	8	9	10	"	"	"	"
73	"	"	"	"	0	5	6	9	11	11	13	"	"	"	"
74	"	"	"	"	0	4	5	6	6	6	6	"	"	"	"
75	"	"	"	"	2	5	9	10	14	14	15	"	"	"	"
76	"	"	"	"	0	4	7	10	10	12	15	"	"	"	"
77	"	"	"	"	3	6	12	15	17	17	21	"	"	"	"
78	"	"	"	"	2	6	13	15	17	18	18	"	"	"	"
79	"	"	"	"	2	5	8	14	17	18	19	"	"	"	"
80	"	"	"	"	0	4	8	14	17	18	18	"	"	"	"
81	"	"	"	"	1	7	11	14	16	17	18	"	"	"	"
82	"	"	"	"	2	5	7	13	17	17	18	"	"	"	"

CONFIDENTIAL

CONFIDENTIAL



PAGE NO. 61
REPORT NO. ER-365

CONFIDENTIAL

12 GAGE SHOTGUN

Round Number	Weight Grains in Rounds	of Projectiles	Type of Projectile		Hits in Diameter							Type of Round	Range Yards	Per cent Hits	Per cent Hits 12 ft Diam.	Report Page No.
			Cant Angle	Length Spun	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Total					
83	530	21	30	.175	1	9	13	16	19	20	20	ER228	100			ER228 or ER137H p.5
84	"	"	"	"	3	6	10	11	14	14	20	"	"			"
85	"	"	"	"	5	10	12	13	15	13	13	"	"			ER137J p.21
86	"	"	"	"	5	7	11	12	15	17	13	"	"			p.22
87	"	"	20	.150	0	1	3	4	6	7	8	"	"	38	38	ER137 Aug. p.23
88	"	"	20	.150	2	2	5	9	11	11	13	"	"	62	62	"
89	"	"	"	"	3	8	12	13	13	15	20	"	50	95	95	"
90	"	"	"	"	2	11	14	16	18	19	20	"	50	95	90	"
91	"	"	"	"	0	3	4	7	7	8	10	"	100	48	38	"
92	"	32	"	"	0	2	7	7	12	15	16	"	"	50	47	ER137 Sept. p.8
93	"	"	"	"	1	4	4	7	8	9	10	S	"	31	28	"
94	"	"	"	"	1	4	4	6	11	12	13	R	"	41	37	"
95	"	21	30	.175	1	3	5	10	12	18	19	Q	"	90	86	"
96	"	"	"	"	0	2	4	9	9	12	14	Q	"	67	57	"
97	"	"	20	.150	1	1	6	9	12	16	21	ER228	"	100	76	"
98	"	"	"	"	1	2	8	11	13	16	17	"	"	81	76	"
99	"	"	"	"	2	5	7	11	13	17	18	"	"	86	81	"
100	"	"	"	"	1	4	8	9	10	10	12	"	"	57	43	"
101	"	"	30	.175	2	3	5	6	14	16	19	"	"	90	76	"
102	"	32	20	.150	2	2	7	11	16	20	22	A	"	69	62	p.9
103	"	"	"	"	1	2	6	8	10	11	12	A	"	37	34	"
104	"	"	"	"	0	4	10	12	15	17	20	A	"	62	53	"
105	"	"	"	"	0	4	8	14	17	22	24	A	"	75	59	"
106	"	"	"	"	0	2	2	7	16	18	22	A	"	69	56	"
107	"	"	"	"	1	2	7	8	10	14	14	A	"	44	44	"
108	"	"	"	.160	0	0	0	1	2	2	4	E	"	12	6	p.10
109	"	"	"	"	1	2	4	5	9	10	16	E	"	50	31	"
110	"	"	"	"	1	2	4	5	6	9	11	E	"	34	25	"
111	"	"	"	"	2	8	13	19	23	24	26	C	"	81	75	"
112	"	"	"	"	1	2	4	7	9	9	12	C	"	37	25	"
113	"	"	"	"	0	6	11	18	21	23	27	B	"	84	72	"

CONFIDENTIAL



PAGE NO. 62
REPORT NO. ER-365

CONFIDENTIAL

12 GAGE SHOTGUN

Round Number	Weight of Projectile Grains in Rounds	Type of Projectile Cant Angle	Length & Open	Hits in Diameter					Type of Round	Range Yards	Per cent Hits	Per cent Hits	Report 12 ft Page
				2 ft	4 ft	6 ft	8 ft	10 ft					
114	21	20	.160	4	4	4	10	14	17	19	19	90	ER137 Sept. 10
115	"	"	"	0	5	9	13	14	16	16	16	76	"
116	"	"	"	2	2	4	8	10	14	16	16	76	"
117	"	"	"	1	5	10	13	18	18	19	19	90	"
118	32	"	"	1	2	4	4	9	11	12	12	37	"
119	"	"	"	3	5	6	10	14	15	18	18	56	"
120	"	"	"	0	0	3	7	9	11	17	17	53	"
121	"	"	"	3	8	13	19	24	26	28	28	37	"
122	"	"	"	3	9	19	23	25	27	31	31	51	"
123	"	"	"	0	3	4	8	10	10	19	19	97	"
124	"	"	"	3	7	9	11	13	15	21	21	59	"
125	"	"	"	0	0	2	6	10	13	18	18	56	"
126	"	"	"	0	0	6	9	11	13	13	13	41	"
127	"	"	"	0	1	2	6	9	11	13	13	41	"
128	"	"	"	1	5	8	12	12	14	14	14	44	"
129	"	"	"	1	4	10	14	14	16	18	18	56	"
130	23	"	"	7	11	17	21	22	23	23	23	100	"
131	21	"	"	0	1	5	5	12	14	18	18	86	ER137 Oct. 7
132	"	"	"	0	1	5	9	10	12	16	16	57	"
133	"	"	"	0	0	1	3	4	6	11	11	52	"
134	"	"	"	0	1	4	8	9	12	14	14	67	"
135	"	"	"	0	3	4	5	6	6	9	9	43	"
136	32	"	"	4	9	19	27	28	28	28	28	87	"
137	"	"	"	9	26	31	32	32	32	32	32	100	"
138	"	"	"	4	8	14	18	19	19	19	19	59	"
139	"	"	"	8	13	17	20	21	21	21	21	66	"
140	"	"	"	0	1	3	6	11	14	23	23	44	"
141	"	"	"	1	1	4	5	7	9	18	18	28	"
142	"	"	"	1	3	3	7	9	11	20	20	34	"
143	"	"	"	1	3	4	7	9	13	26	26	81	"
144	"	"	"	0	1	2	7	10	15	25	25	78	"
145	"	"	"	0	3	6	8	9	10	20	20	62	"

** Rd. packed by Mr. Bird, O. C. O.

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12 GAGE SHOTGUN											
Round Number	Weight of Projectiles in Rounds	Cant Angle	Type of Projectile	Span	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Total
Number	Grains										
146	32	2°		.160	1	1	2	7	8	12	16
147	"	"		"	1	2	3	8	9	10	17
148	"	"		"	0	2	2	2	3	4	13
149	"	"		"	0	2	6	9	10	13	26
150	"	"		"	0	3	5	9	10	11	22
151	"	"		"	1	2	4	5	7	9	21
152	"	"		"	0	3	6	8	9	12	19
153	"	"		"	0	0	4	10	11	12	17
154	"	"		"	0	0	2	4	7	8	21
155	"	"		"	1	5	10	12	18	21	26
156	"	"		"	0	0	4	6	7	10	16
157	"	"		"	0	1	3	6	6	11	23
158	"	"		"	0	2	5	7	12	19	30
159	636	"		"	1	2	3	7	7	10	16
160	636	"		"	0	2	5	7	12	19	30
161	636	"		"	0	2	3	7	13	15	22
162	639	"		"	0	2	5	7	10	11	17
163	639	"		"	0	2	4	8	10	11	22
164	639	"		"	2	6	11	15	17	20	30
165	665	"		.150	0	2	4	7	13	16	21
166	663	"		"	1	3	9	13	15	20	27
167	660	"		"	0	4	4	5	7	11	24
168	678	"		"	0	4	4	12	14	16	26
169	678	"		"	1	3	8	13	14	21	27
170	678	"		"	2	5	6	7	8	11	26
171	628	"		.160	0	0	2	6	9	13	25
172	630	"		"	1	5	12	15	18	19	29
173	629	"		"	2	3	6	9	10	13	29
174	699	"		"	1	3	8	10	13	15	28
175	695	"		"	1	1	1	2	2	6	13
176	690	"		"	0	0	1	2	4	6	28
177	570	"		"	0	2	6	9	12	15	24
178	571	"		"	1	2	7	10	15	19	23

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12 GAGE SHOTGUN

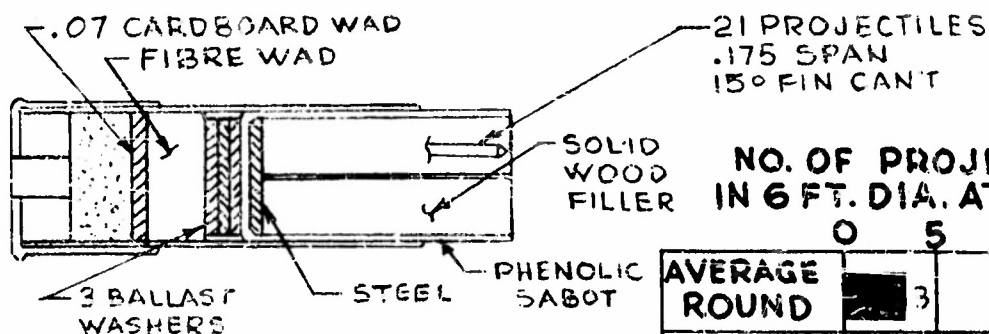
Round	Number of Pro- jectiles	Weight Grains	Number Grains	Cant Angle	Type of Projectile Length & Span.	2 ft	4 ft	6 ft	8 ft	10 ft	12 ft	Total	Type of Round	Range Yards	Hits Diam.	Per- cent Hits	Report Page No.
179	32	630	32		.160	1	3	4	9	13	17	21	F1	100			
180	"	"	"		"	0	5	6	16	20	23	31	"	"	"		
181	"	"	"		"	3	7	11	16	18	24	31	"	"	"		
182	"	"	"		"	3	6	10	11	13	16	27	"	"	"		
183	"	"	"		"	1	4	11	15	21	23	31	"	"	"		
184	"	"	"		"	0	2	7	10	13	15	22	"	"	"		
185	28	570	28		"	2	3	3	6	8	9	20	T	"	"		
186	"	"	"		"	2	5	12	16	16	19	25	"	"	"		
187	"	"	"		"	0	3	6	11	13	15	17	"	"	"		
188	"	"	"		"	0	0	1	3	5	7	17	"	"	"		
189	32	640	32		"	1	2	3	7	9	14	28	U	"	"		
190	"	"	"		"	2	4	5	8	12	16	27	"	"	"		
191	"	570	"		"	1	5	7	11	16	16	28	V	"	"		
192	"	"	"		"	0	3	9	10	11	14	29	"	"	"		

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12 GAGE SHOTGUN

ROUND TYPE-ER 228-IV



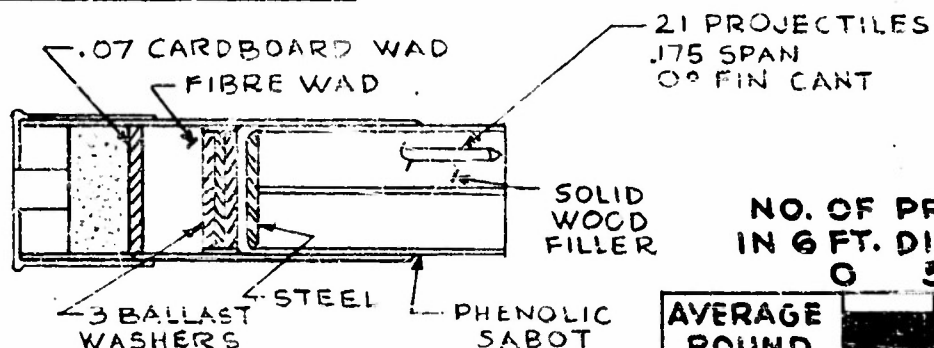
NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	3				
BEST ROUND	NO RECORD				

TOTAL ROUNDS FIRED-3

ROUND TYPE-ER 228-V



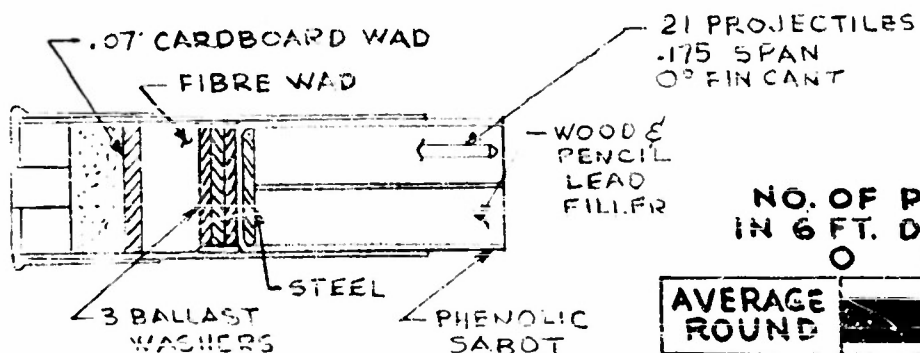
NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	8				
BEST ROUND	8				

TOTAL ROUNDS FIRED-1

ROUND TYPE--Δ I



NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	5.5				
BEST ROUND	6				

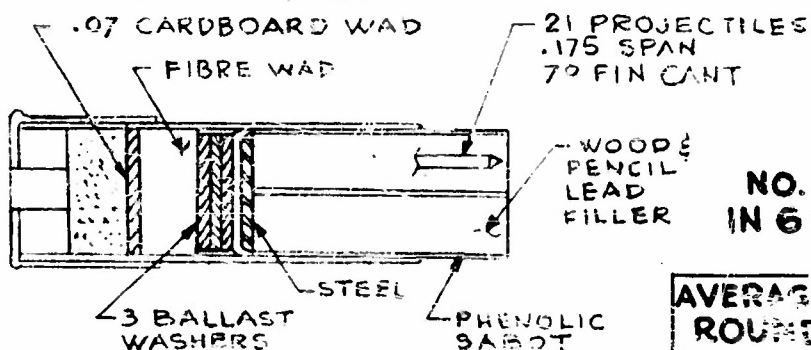
TOTAL ROUNDS FIRED-

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12 GAGE SHOTGUN

ROUND TYPE- Δ II

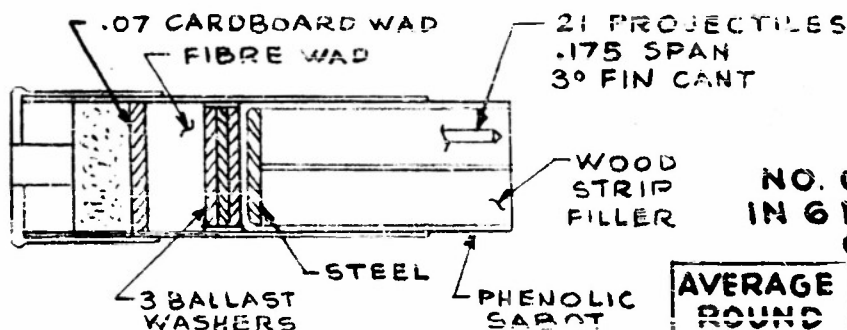


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			10.5		
BEST ROUND			11		

TOTAL ROUNDS FIRED-2

ROUND TYPE-□

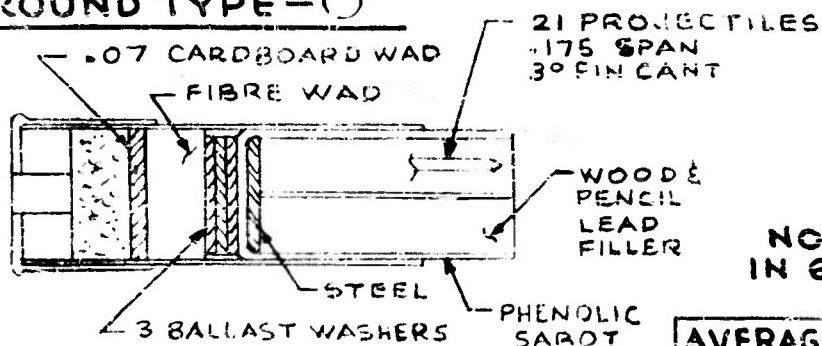


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			12.7		
BEST ROUND					17

TOTAL ROUNDS FIRED-4

ROUND TYPE-○



NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND					17
BEST ROUND					17

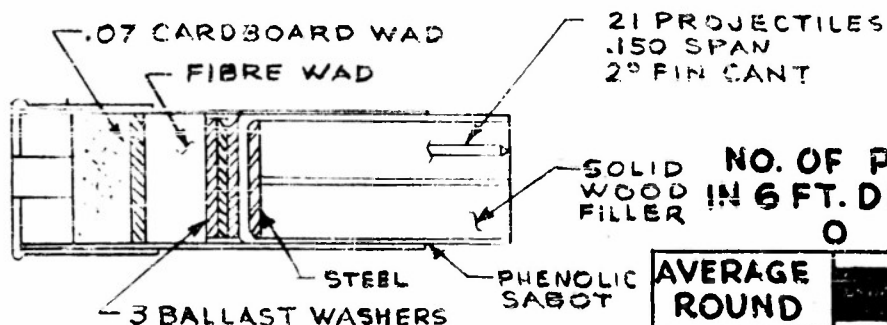
TOTAL ROUNDS FIRED-3

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12 GAGE SHOTGUN

ROUND TYPE-- ER 228 I



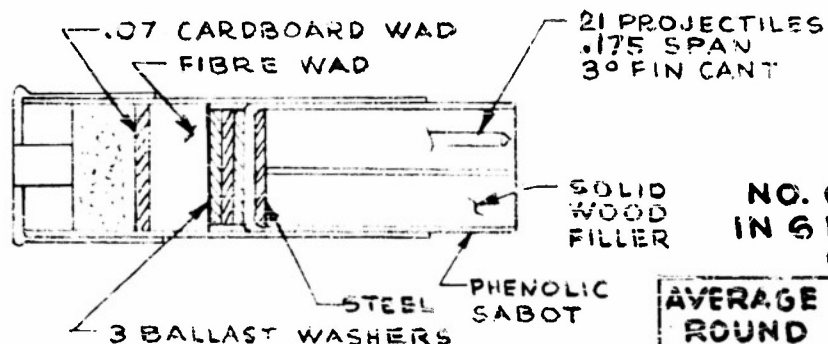
NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	6			
BEST ROUND	7			

TOTAL ROUNDS FIRED-9

ROUND TYPE - ER 228 II



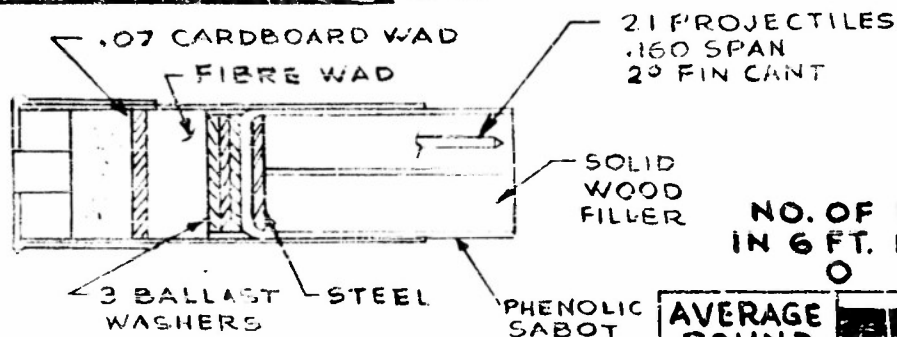
NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	7.5			
BEST ROUND	14			

TOTAL ROUNDS FIRED-49

ROUND TYPE-ER 228 III



NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

0 5 10 15 20

AVERAGE ROUND	4.7			
BEST ROUND	10			

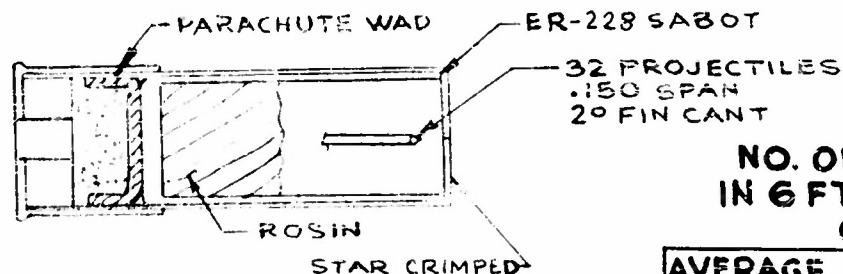
TOTAL ROUNDS FIRED-7

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1. 6 GA. SHOTGUN

ROUND TYPE - R

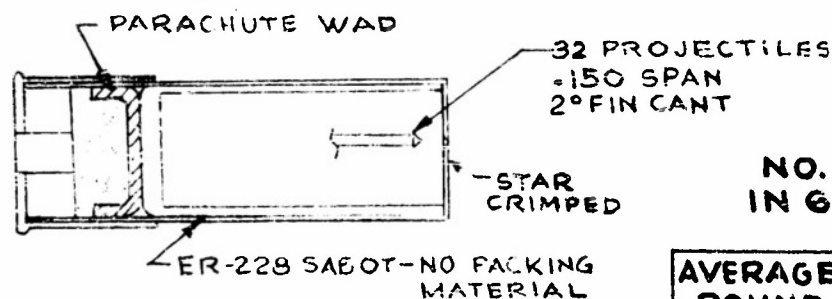


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		5.5			
BEST ROUND		7			

TOTAL ROUNDS FIRED - 2

ROUND TYPE - S

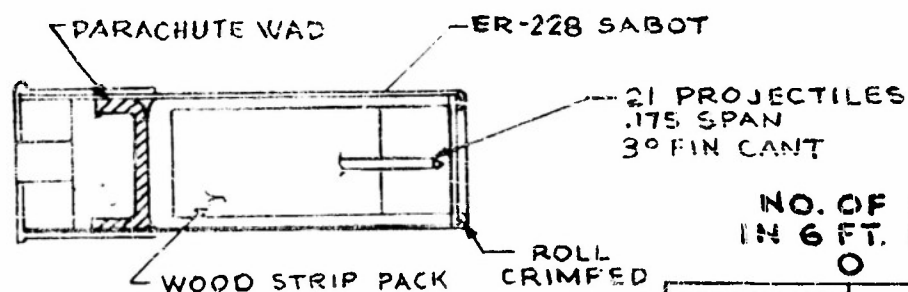


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		4			
BEST ROUND		4			

TOTAL ROUNDS FIRED - 1

ROUND TYPE - QI



NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		4.5			
BEST ROUND		5			

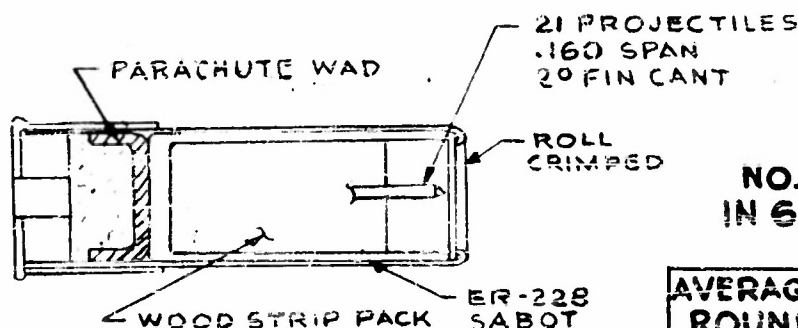
TOTAL ROUNDS FIRED - 2

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12 GAGE SHOTGUN

ROUND TYPE - QII

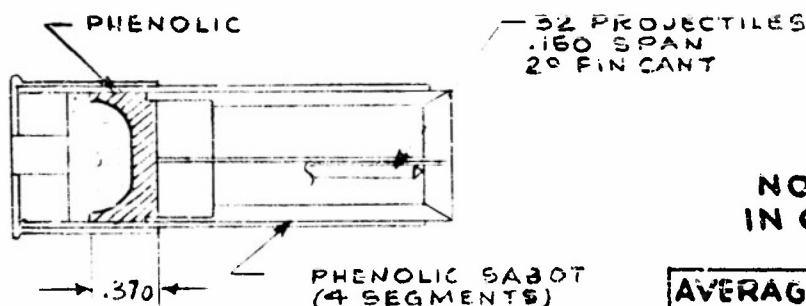


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			9.5		
BEST ROUND			10		

TOTAL ROUNDS FIRED - 2

ROUND TYPE - A

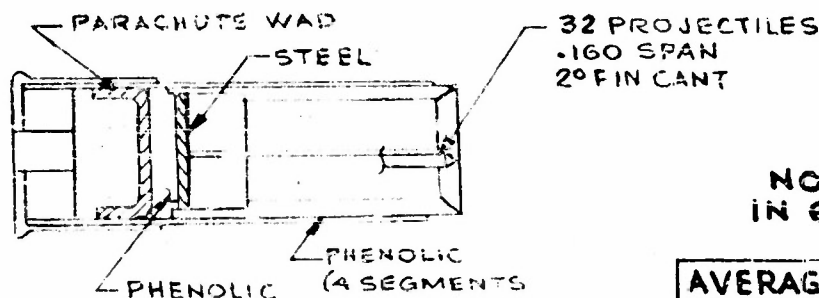


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			6.7		
BEST ROUND			8		

TOTAL ROUNDS FIRED - 6

ROUND TYPE - E



NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND			3.1		
BEST ROUND			6		

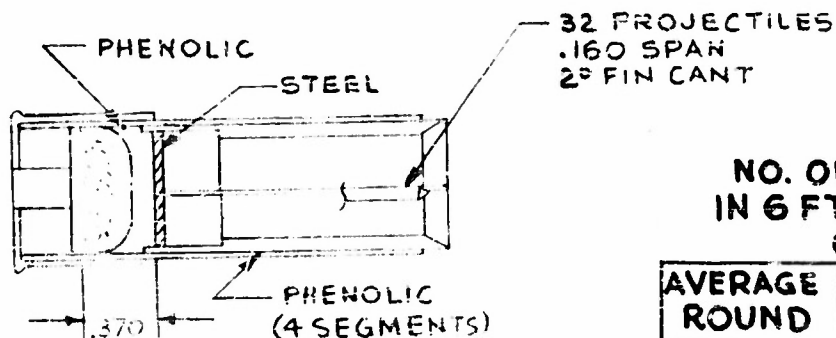
TOTAL ROUNDS FIRED - 8

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ROUND TYPE - B

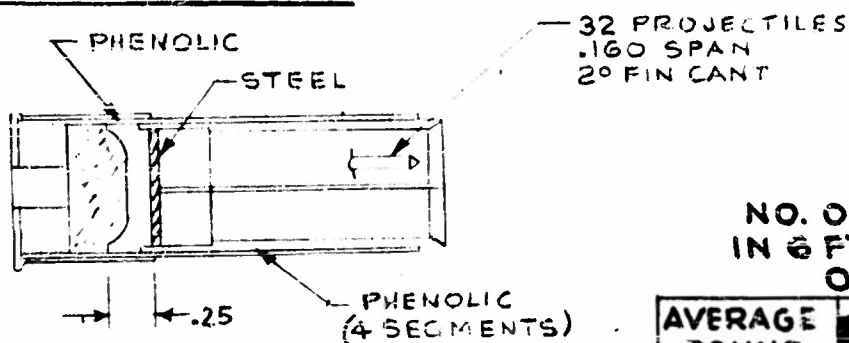


TOTAL ROUNDS FIRED - 8

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND			6.5		
BEST ROUND				11	

ROUND TYPE - C

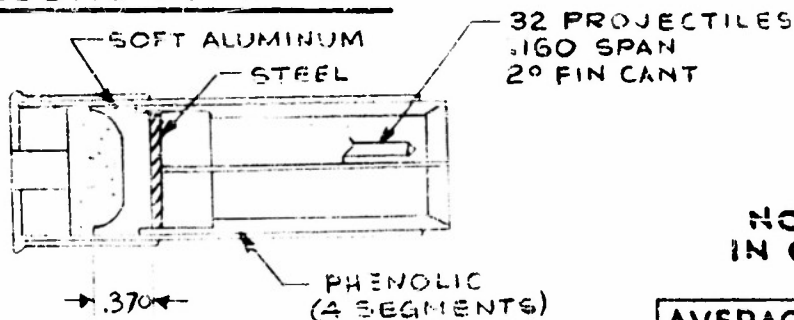


TOTAL ROUNDS FIRED - 8

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND			4.6		
BEST ROUND				13	

ROUND TYPE - D



TOTAL ROUNDS FIRED - 12

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

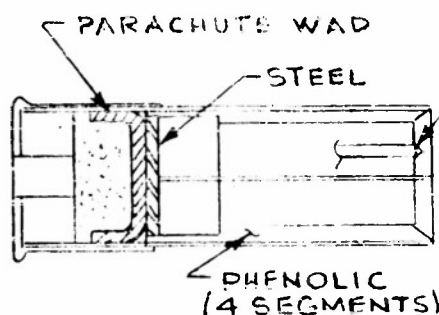
	0	5	10	15	20
AVERAGE ROUND			7		
BEST ROUND					19

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ROUND TYPE - F



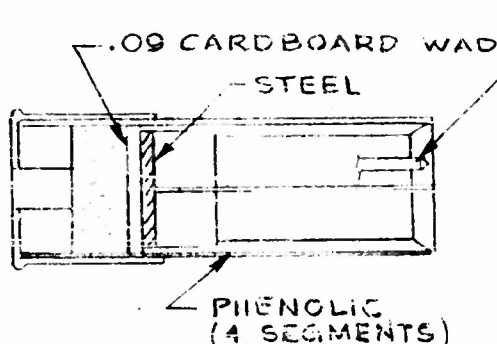
32 PROJECTILES
.160 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND	2				
BEST ROUND	2				

TOTAL ROUNDS FIRED - 1

ROUND TYPE - G



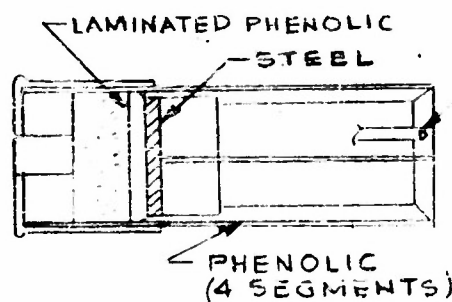
32 PROJECTILES
.160 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND	8				
BEST ROUND	8				

TOTAL ROUNDS FIRED - 1

ROUND TYPE - H



32 PROJECTILES
.160 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND	10				
BEST ROUND	10				

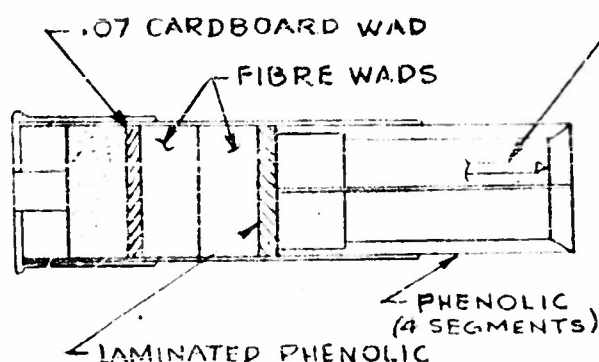
TOTAL ROUNDS FIRED - 1

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12 GAGE SHOTGUN

ROUND TYPE--J



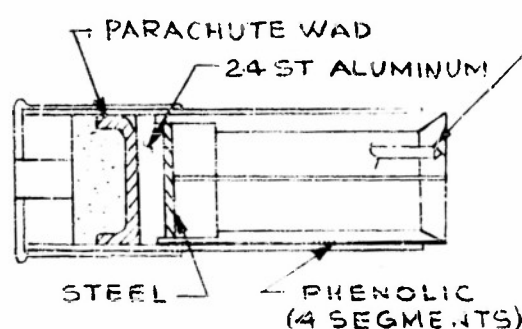
32 PROJECTILES
.160 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND				13.5	
BEST ROUND				16	

TOTAL ROUNDS FIRED-- 2

ROUND TYPE - K



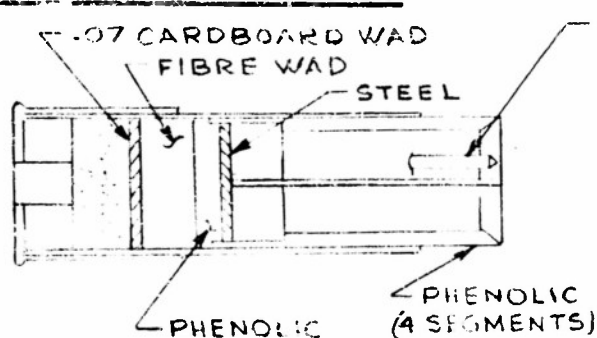
32 PROJECTILES
.160 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		5			
BEST ROUND		5			

TOTAL ROUNDS FIRED-- 3

ROUND TYPE - L



32 PROJECTILES
.160 SPAN
2° FIN CANT

NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		3.7			
BEST ROUND			10		

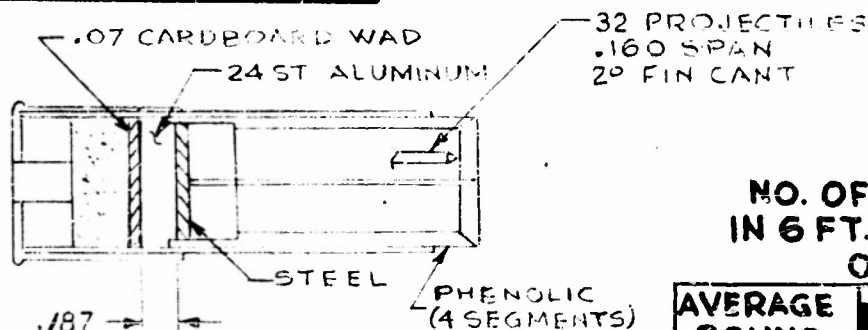
TOTAL ROUNDS FIRED-- 6

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12 GAGE SHOTGUN

ROUND TYPE - M

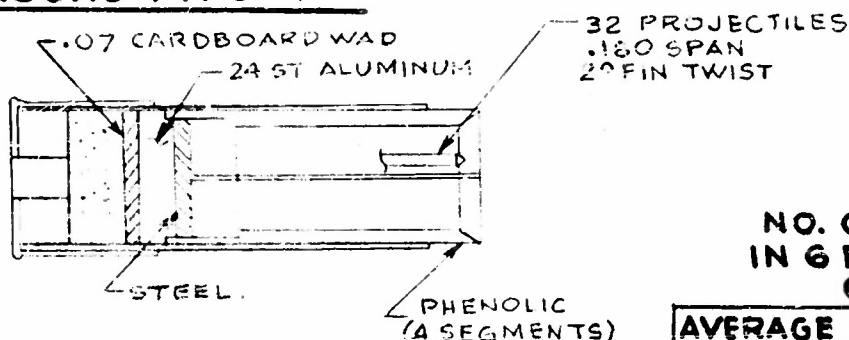


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		5.3			
BEST ROUND			9		

TOTAL ROUNDS FIRED - 3

ROUND TYPE - N

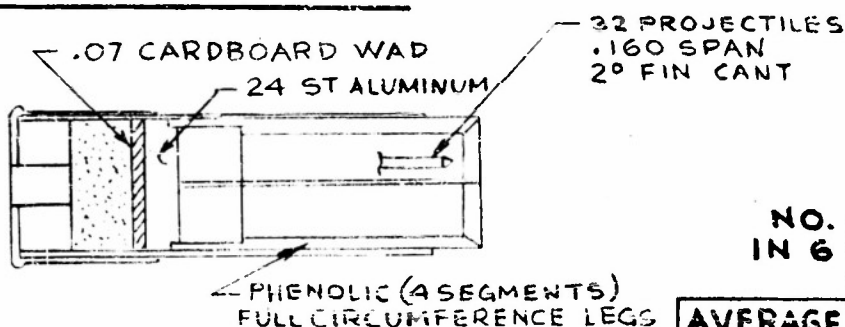


NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		6			
BEST ROUND			8		

TOTAL ROUNDS FIRED - 3

ROUND TYPE - PI



NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.

	0	5	10	15	20
AVERAGE ROUND		7.7			
BEST ROUND			11		

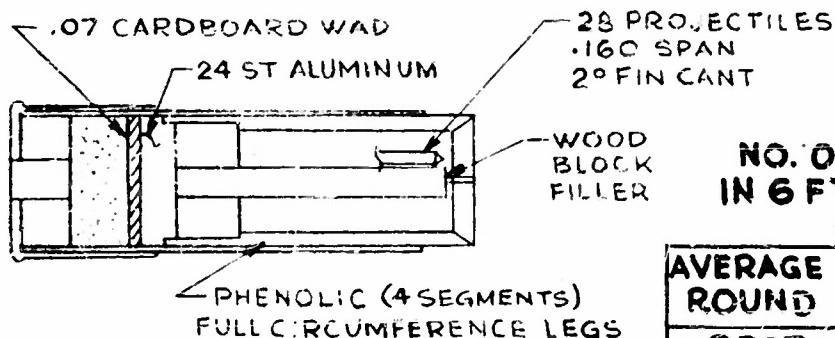
TOTAL ROUNDS FIRED - 9

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12 GAGE SHOTGUN

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ROUND TYPE - PII

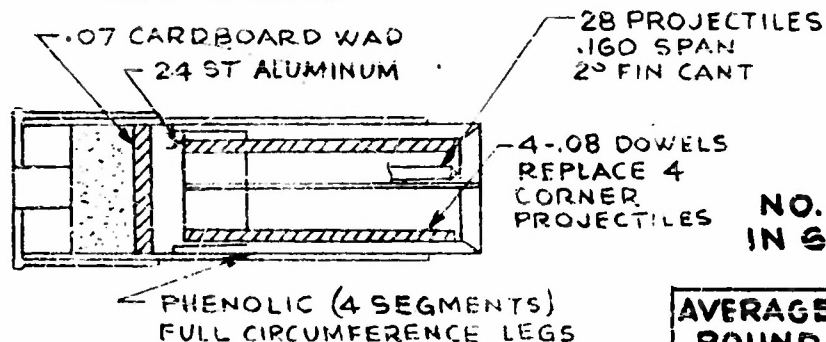


TOTAL ROUNDS FIRED-2

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND		6.5			
BEST ROUND		7			

ROUND TYPE - T

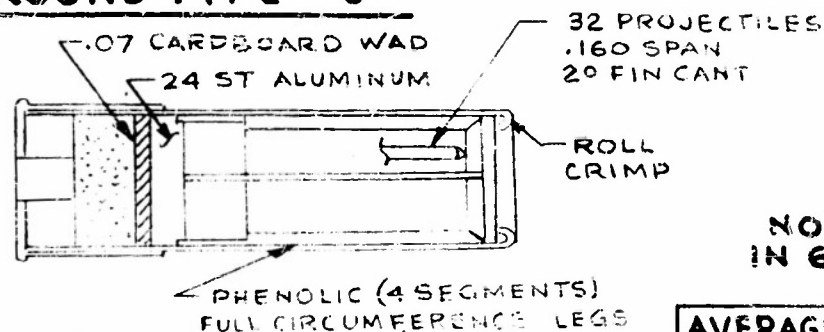


TOTAL ROUNDS FIRED-4

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND		5.4			
BEST ROUND			12		

ROUND TYPE - U



TOTAL ROUNDS FIRED-2

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

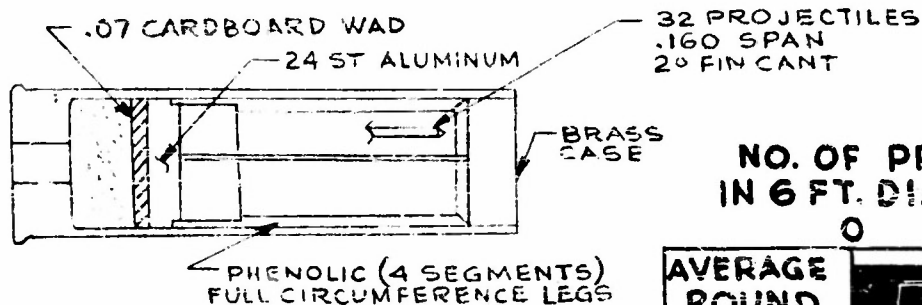
	0	5	10	15	20
AVERAGE ROUND		4			
BEST ROUND		5			

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12 GAGE SHOTGUN

ROUND TYPE-V



**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND		8			
BEST ROUND		7			

TOTAL ROUNDS FIRED-2

ROUND TYPE -

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND					
BEST ROUND					

TOTAL ROUNDS FIRED-

ROUND TYPE -

**NO. OF PROJECTILES
IN 6 FT. DIA. AT 100 YDS.**

	0	5	10	15	20
AVERAGE ROUND					
BEST ROUND					

TOTAL ROUNDS FIRED-

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